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THREE
ESSAYS
IN

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Artificial Philosophy,
OR
UNIVERSAL CHEMISTRY:

VIZ.

- I. An ESSAY for the farther Application and Advancement of CHEMISTRY, in *England*.
- II. An ESSAY for the Improvement of DISTILLATION, in the Hands of the *Malt-Stiller, Rectifier, Compounder, and Apothecary*.
- III. An ESSAY for Concentrating WINES, and other FERMENTED LIQUORS; or taking the Superfluous Water out of them to advantage.

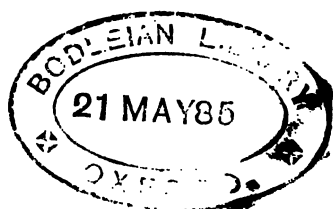
By PETER SHAW, M. D.

L O N D O N:

Printed for J. OSBORN, and T. LONGMAN, at the
Ship in Pater-noster-Row.

M.DCC.XXXI.

1938. e. 1.



T O

Dr. Middleton Massey,
FELLOW of the *Royal College*
of PHYSICIANS,

And of the
ROYAL SOCIETY, *London.*

S I R,

A S I desire to put my *Chemical*
Essays into such hands as are
capable of improving them; you'll
please to accept these THREE in the
View they are presented you, by

Your very Humble Servant,

PETER SHAW.

ADVERTISEMENT.

Somewhat of our general Design, whereof the present Essays make a part, was intimated in the Philosophical Principles of Chemistry we lately published. That Work indeed was not our own; but claims for its Author no less a Person than an Aulic Counsellor, and Chief Physician to his Prussian Majesty. We however took the liberty to adopt it, as a thing extremely useful to our Design of recommending the farther Cultivation and Improvement of Chemistry. For, as it contains the solid Elements of Chemical Knowledge in general, and opens new Views of infinite Extent; we could not do
better

better than make it a Foundation, whereon to raise a Structure of practical or artificial Philosophy, for the service of ordinary Life.

To open this general Design more fully, we have here, First, employed an entire Essay; containing the whole Scheme; explaining the Nature, and proper Uses of Chemistry; and sketching out the methods of practising it in full Latitude.

Next, as we propose ourselves to tread in the Paths we chalk out; and to supply, as well as explain, or illustrate; we give a Specimen of a Subject, that has not been touched upon to purpose, by any one that we know of; and treat in our manner the business of common Distillation, or the Production and Refinement of INFLAMMABLE SPIRITS.

Thirdly, we endeavour to illustrate and improve a Subject already treated

by Dr. Stahl; viz. *the business of Condensing Wines, or reducing them to a small bulk, without prejudice : and this by way of a Praxis upon the fundamental Doctrine of Fermentation, laid down in the Philosophical Principles of Chemistry. And here we stop for the present.*

The next Set of Essays intended, are, (1.) For introducing a PORTABLE LABORATORY ; by means whereof all the Chemical Operations are commodiously perform'd, for the purposes of Philosophy, Medicine, Metallurgy, and a Family.

(2.) An ESSAY towards the natural and experimental History of WINES; foreign and domestic. And,

(3.) An ESSAY upon the Art of finding, judging, and digging of MINES ; and separating, purifying, and working of METALS, from the Ore, to the Utenfil. *We*

We farther propose to continue, in this manner, publishing, at times, two or three ESSAYS together; one in Philosophical, one in Technical or Commercial, and another in Oeconomical Chemistry; as we can find opportunity to finish them.



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BOOKS printed for JOHN OSBORN and THOMAS LONGMAN.

I. **P**hilosophical Principles of Universal Chemistry: or, the Foundation of a scientific Manner of inquiring into, and preparing the natural and artificial Bodies for the Uses of Life, both in the smaller way of Experiment, and the larger way of Business. Designed as a general Introduction to the Knowledge and Practice of artificial Philosophy, or genuine Chemistry in all its Branches. Drawn from the *Collegium Jenense* of Dr. George Ernest Stahl. By Peter Shaw, M.D.

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ERRATA.

- P**AG. 22. marg. for *anning* read *Tarning*.
 — 58. line 25. for *hal* read *half*.
 — 68. — 6. for *Sprits* read *Spirits*.
 — 83. Note, line 1. read *for the*.
 — 92. Note, read *An. 1699, & An. 1718*.
 — 176. line 25. dele *same*.

An ESSAY, for the farther Application and Advancement of Genuine CHEMISTRY in England.

AN impartial Consideration of *Chemistry*, Chemistry
disregarded
in England, in its proper Extent and necessary Relations, may perhaps shew it of that use and benefit in Life, as to deserve the particular regard of this *Kingdom*, which at present appears remarkably to overlook, condemn, or despise it.

Chemistry may be conceived as the business of General Definition, actually resolving, separating, mixing, combining, new modifying, and changing the Forms of the various Bodies, whether produced by Nature, by Art, or by Accident, in this Globe of ours; with a view to search into their *internal Structure* and *secret Relations*, so as to find out some new Properties or Uses thereof, and thence increase our knowledge of these Bodies, or ultimately render them, one way or other, more serviceable in human Life*.

If this Description be just, it will follow, that whoever would understand the true import and real

* See Pag. 19.

Of Philosophical Chemistry.

real business of *Chemistry*, must view and consider it in a state of Action and manual Operation; or, as it practically contributes to enlarge the Understanding, supply the Necessities, and afford the Conveniences of Life: which is the Light wherein the Lord *Verulam*, and Mr. *Boyle* have justly placed and considered it.

To give a fair and full Representation of *Chemistry*, in so extensive a view, must be the Work of Ages: and before any step can be taken in it to satisfaction, the Subject requires a Division into several Branches; each whereof being gone over a-part, may give some general Notion of the whole.

*And general
Division of
the Art.*

The most useful Division seems aptly to fall under the comprehensive *Heads*, or *Titles*, of *Philosophical*, *Technical*, *Commercial*, and *Æconomical Chemistry*.

S E C T. I.

Of Philosophical CHEMISTRY.

*Philosophi-
cal Chemi-
stry explain-
ed;*

I. **P**hilosophical Chemistry is that particular part, which, contented with things entertaining, satisfactory, and instructive to the Mind, does not directly and solicitously endeavour after such as are immediately useful, or advantageous.

2. In this view, *Philosophical Chemistry* will consist of three Parts, viz. *Invention*, *Rationale*, and *Experiment*. Whence it might be defin'd, the particular Exercise of the inventive and rational Faculties of the Mind upon Chemical Subjects, Operations, and Effects, leading up to Experiments and back again; so as to draw Conclusions, ac-
count

count for Phænomena, start Problems, and attempt their Solution, in this Circle successively*.

3. *Philosophical Chemistry*, therefore, is the Source ^{And divided.} and Soul of the whole Art; as by inventing, reasoning, comparing, and adjusting of things, directing Experiments, and concluding from the Result, it forms new Doctrines, and makes new Discoveries, for itself, and all the other Branches, to improve and apply.

4. In the way of *Invention*, this part of *Chemistry* ^{Applicable in the way of Invention,} is more particularly applicable; (1.) To the *Imitation* of natural and artificial Things: (2.) To the *Production* of new artificial Bodies: (3.) To the *starting* of new Arts and Trades: And, (4.) To the *supplying* of *Desiderata*, or *Defects* in the old ones.

(1.) As natural Bodies may be so resolved or ^{To the Imitation of natural and artificial Bodies.} taken to pieces, as in many cases to discover their constituent Parts, or Ingredients; *Philosophical Chemistry* hence forms Rules for imitating various Productions of Nature; which, in some particulars, is done to great Exactness; as in the making of *Cinnabar*, *Vitriol*, &c. where the Resolution has been found easy; in others less exactly, where, by the common Methods, the Resolution has hitherto proved more difficult, as in the Business of *artificial Gems* and *Metals*; tho' some well-meant Attempts have appear'd in this way too.

The like also is to be understood of *artificial Bodies*, made in one Country, and imitated in another; whence the Imitation of *Venice-Glass* in *England*, the Imitation of *Porcellane*, the *Japan Varnish*, various Refinements of foreign

B 2

Drugs,

* Nec manus nuda, nec intellectus sibi permissus, multum valet: instrumentis & auxiliis res perficitur; quibus opus est non minus ad intellectum quam ad manum. BACON.

Of Philosophical Chemistry.

Drugs, Sugar, &c. in *Europe*: all which, where not casual, are of pure chemical Extraction: and the proper Enquiries into things of this kind, fall under the *inventive* Part of *Philosophical Chemistry*.

The Production of new artificial Bodies.

(2.) New *artificial Bodies* are chemically producible *ab Origine*, either in the way of Separation, or Combination.

In the way of *Separation*, Chemistry has invented and produced fermented potable Liquors, inflammable Spirits, Salts, Sugar, Pot-Ash; those vulgarly call'd *Chemical Preparations*, as Oils, Extracts, Spirits, &c. various Pigments, and all the pure and unmix'd Metals: And in the way of *Combination*, it has produced Soap, Glass, Vitriol, Gun-Powder, all the mix'd or artificial Metals, &c.

The Starting of new Arts and Trades,

(3.) Arts and Trades are the genuine Fruits or Consequences of the preceding Discoveries; in which view *inventive Chemistry* is the Purveyor to all the other Branches; and has thus struck out a very large number of Hints, which are frequently form'd into Trades. Thus the Invention of *Aqua fortis*, for example, has given rise to the Scarlet-Dye, the Business of Etching, the Art of Refining, &c.

And supplying their Defiderata.

(4.) And as *Inventive Chemistry* strikes out new Arts and Trades, 'tis no less capable of discovering means to promote them, or supply the Defects, which may appear in their first Establishment, or retard their farther Advancement. Instances of this kind are every where to be met with; particularly in the Arts of Sugar-baking, Soap-boiling, Fermenting, Distilling, &c. wherein many shorter and better Methods of working have been severally discover'd.

§. I. Of Philosophical Chemistry.

5

5. In the way of *Rationale, Philosophical Chemistry* is particularly applicable : (1.) To the *accounting for Natural and Artificial Phænomena, and Effects* : (2.) To the *Explanation of the general and particular Properties, or Forms and Qualities of Bodies* : (3.) To the *Discovery of the Chemistry of Nature* : (4.) To the *Consideration of Natural and Artificial Transmutations* : And (5.) To the *giving a rational Theory of Medical Matters*.

(1.) *Philosophical Chemistry* accounts for many Natural and Artificial Phænomena and Effects, as it is often in the power of this Art to imitate the same ; whence, reasoning by just Analogy, it may be allow'd to give fair and satisfactory Solutions. After this manner it endeavours to account for Lightning and Thunder, with their strange Effects ; the *Aurora Borealis*, Earth-quakes, Vulcano's, &c. And much in the same way it solves the Phænomena of Gun-Powder, the *Phosphori*, and various other surprizing Productions of Chemistry itself.

(2.) As this Part of *Philosophical Chemistry* is used to explain the general and particular Properties, or Forms and Qualities of Bodies, it considers, Heat, Cold, Light, Moisture, Dryness, Volatility and Fixedness, Fluidity and Firmness ; Continuity and Contiguity, Colours, Tastes, Odours, Congelation and Conglaci-ation, Effervescences, Fermentations, Putrefaction, Solution, Precipitation, and the various Operations of Chemistry, with numerous other Phænomena ; so as to shew how they are produced, affected, altered, or changed in Bodies ; and thence to make out their general and particular Histories.

(3.) *Philosophical Chemistry* finds many Reasons for allowing a *Chemical Agency* in the Production

duction of natural Bodies, and their manner of acting upon one another; whence they bring about a kind of true Chemical Effects. And upon this Foundation the original Composition and Structure of natural Bodies is rationally accounted for; with the operations and effects of the Elements upon each other. Thus Water and Air may be chemically considered as two grand Menstruums of Nature, which, by means of the Sun's heat, and the subterranean warmth, are continually at work upon all sublunary Bodies, in order to bring forward various Changes, Regenerations and Transmutations, &c. Whence the origin and appearances of Meteors; the generation of Hail, Snow, Rain, Metals, Minerals, &c. And thus all Vegetation, Animalization and Mineralization (if these Words are allowable) may be considered and accounted for, as operations or effects of *Natural Chemistry*.

Considering
of natural
and artificial
Transmutations,

(4.) The business of *Natural and Artificial Transmutations* falls the more particularly under the *Rationale* of Chemistry, as little else but consideration and reasoning is required to understand and apply it. These Transmutations may be *entirely Natural*, or *entirely Artificial*; or *partly Natural* and *partly Artificial*. Under the entirely natural come such as those produced by Putrefaction, long standing or digesting in the Air, Water or any natural Fluid; whence Animal Substances are converted into Vegetables, Wood into Stone, Metals into one another, Bodies into Air, Water, Fire, &c. and these are again into Bodies.

The Transmutations effected by the joint Concurrence of Nature and Art, are such as those

those made by Fermentation ; where Art puts the subjects together, and rightly disposes them, but Nature performs the business: so in the making of Paper, Art stamps the Rags, but Nature half putrefies the Matter ; and thus contributes to change it.

The *Transmutations* purely Artificial are such as those made by Triture, Mixture, long Digestion, and other Chemical Operations ; as in extracting the Mercuries of Metals : and several other instances in the sublimer Metallurgy.

Whether these Artificial Transmutations be real or only apparent, is not so much the question ; those who will not allow them for Transmutations, may call them alterations or changes of one Form into another : and perhaps they may be no more at the bottom ; for if the changed body be not always artificially reducible to its pristine state again, (which is supposed the Criterion of an Artificial Transmutation) this may be owing not to any impossibility in the thing, but to the want of a suitable method for doing it.

(5.) A just *Theory* of many *Medical Matters* And settling the Theory of Physic. will naturally flow from the foregoing Considerations, or from a particular application of the *Rationale* of *Philosophical Chemistry* to the human Body ; with a view to observe its natural state, its disorders, and the effects of Remedies. Thus in particular it helps to clear up the disputes about Animal Digestion, Chylification, Sanguification, Nutrition, &c. shews how the Blood and Humours are altered by Heat, Cold, Motion, Attrition, &c. whence the Origin, Nature, Duration and Phænomena of Distempers, and their Manner of Cure.

*Applicable,
in the way
of Experiment,
to the
establisbing
a Theory of
chemical
Matters.*

6. In the way of Experiment, *Philosophical Chemistry* is universally applicable, and many times absolutely necessary to the farther examination, illustration and confirmation of the preceding parts, or the whole Theory of the Art ; which indeed cannot subsist without it. For tho' some kind of Theory might be formed of *Philosophical Matters* independant of Experiments; yet such Theories have usually been found barren, unsound or useles; so as in no respect to be safely trusted *.

*Bringing
Inventions
to the Test.*

7. It is the peculiar province of this part of *Philosophical Chemistry* to bring new Inventions and Theories to the Touch-stone ; discover their validity or their insufficiency ; and when found just and solid, to confirm or stamp them with a Character that makes them universally current, and fit to be employ'd for farther uses.

*The advancing
of new
Trades,*

8. Thus when any hint is started for a new Trade, or Chemical Method invented for the improvement of an old one ; before the least attempt is made to apply it in real business, the proper Essay or Experiment must be performed in Miniature ; which proving successful, upon repeated Examination, with due variation of Circumstances, may now encourage the application, or advancement of this discovery into an Art.

*And finding
the Practi-
cability of
Things.*

9. And thus *Philosophical Chemistry* works in Miniature, to try the Truth, and find out the practicability of things ; an Example or Model of which procedure is preserved and particularly retained in the business of *Assaying* ; which beforehand determines the yield of an Ore, and sometimes the best way of working it in large, by previous Experiments made in *Miniature*.

10.

* Omnem Philosophiam ab experientiae radicibus, ex quibus primum pullulavit, & Incrementum cepit, avulsam, rem mortuam esse. BACON.

10. By thus confining it self to work in small, ^{Advantages} or in the way of Trial, Inquiry or Specimen ^{of Philo-} only, *Philosophical Chemistry* has the opportunity ^{sophical Che-} of fully commanding its Subject; which it chuses ^{mistry.} of a proper size for the external Senses to view, and examine on all sides; and observe the phænomena, effects and relations, without being oppress'd with too unwieldy a bulk, or having the Mind distracted with too many Considerations; which might attend a large Work, and retard its advancement to a regular and stated perfection.

11. But when thus the Experimental part of *Philosophical Chemistry* has perfected any discovery, in ^{Contributes} small, with relation to Arts or Trades; and clearly ^{to establish} and solidly shewn how it may be wrought to advantage in large, ^{larger} it has now performed its Office; ^{Works.} and here leaves the thing, or turns it over to the other branches of Chemistry, whose end is advantage, to be carried on in the form of a business. So *Cornelius Drebbel*, when he had fairly essayed and proved the Invention of the Scarlet Dye, gave it up to those who afterwards exercised it as a Trade. And this appears to have been the general way wherein Arts and Trades were originally invented, or first brought into use; for it cannot be supposed, that large Expensive Works should have been set up, before any trial had appeared to encourage them.

12. 'Tis a particular happiness in this business of ^{In what} Experiments, that when an inquiry is made by ^{manner to} their means, a proper set, or competent number, ^{be prosecuted.} of them, gone thro' in due order, will usually give the discovery, or as it were a spontaneous Solution of the Problem. But to practise this method to advantage, requires a judicious Head and a dextrous Hand; with a due observance of ^{of the} the rules laid down by the *Lord Verulam* in his noble Work *de Augmentis Scientiarum*, and *Novum Organum*.

The joint
Effects of
all the
parts of Phi-
losophical
Chemistry.

13. As the several parts of *Philosophical Chemistry* are thus separately applicable to such good purposes; much greater advantage may be reasonably expected from the joint use and mutual assistance which they are capable of affording each other; especially by a prudent management and application. A great deal has been already done in this way, but more remains to be done. The Lord *Bacon* seems to have gone as far as Mortal could, without the assistance of new sets of Experiments in all the parts of *Philosophy*, but principally in *Chemistry*; up to which Experiments his attachment to Nature directly led him: but at the *fiat Experimentum* he judiciously chose to stop, rather than to advance farther by the help of Conjecture, or supposing the Event of Experiments which it would require some Ages to make. As if the *fiat Experimentum* had been directed to Mr. *Boyle*, he took up *Philosophical Chemistry* where the Lord *Bacon* left it; and to what lengths he carried it, the present state thereof may witness.

Chemistry
cultivated in
Germany,

14. But the *English* Philosophers seem at present to be got a little out of this *Chemical Vein*; and applying closer to other Studies, leave the Cultivation of Chemistry to the Philosophers of other Nations. We have had our *Bacons*, our *Digby* and our *Boyle*; Men as eminent in *Chemistry*, as in other parts of useful knowledge: but *Germany* seems more disposed to encourage this Art, where every *Court* has its *Laboratory*, and every *Mountain* its *Mine*; whence it has been usually well supplied with a competent Set of Original Chemists; such as *Agricola*, *Ercker*, *Kunckel*, *Becher*, *Homburg* and *Stabl*.

And Hol-
land.

15. Hence also their contiguous Neighbours the *Dutch* have derived so much of this Art, as suits their purpose; and fits them to supply all
Europe

Europe with Commodities of greatest consumption, new fabricated and refined by their industrious Hands. Nor has less Industry been used of late, to promote the Knowledge of this Art in their Universities; and tho' it be there taught with a view to Medicine only, yet some have hence took occasion to launch into the Ocean of *Philosophical Chemistry*; but particularly *Boërhaave*, that Learned and Assiduous Professor of *Leyden*.

16. But not to leave this business of *Philosophical Chemistry* too loose, it may be necessary to curb and confine it within its own Bounds; so as to keep it from entrenching upon the exercise of certain *Mechanic Arts*, or Trades, on the one hand; and upon the common *Experimental Philosophy* on the other.

Extent and Office of Philosophical Chemistry.

17. *Philosophical Chemistry* seems sufficiently distinguished from the Exercise of Arts by that observation already made, as to its confining it self to work in Miniature, by way of Inquiry, Trial and Specimen only; whereas Arts produce in large, upon a formed and settled Discovery, to supply the Demands of Trade and the Calls of Commerce. So that, for example, there is the same difference betwixt a Substance produced in a Chemical Experiment, and the Commodity produced in the way of an Art, as betwixt the Assay of an Ore in a private Chamber, and the working of the Ore for its Metal in the smelting-Huts. The distinction might otherwise appear from the Invention, Discovery and Reasoning which constantly precede and direct all the original Chemical Experiments; but are wanting in the Exercise of Arts: which have all that done to their hand, and only consist in a repetition of the same uniform Action, or Operation.

Distinguished from Arts.

From Experimental
Philosophy.

18. The Distinction betwixt *Philosophical Chemistry* and the common Experimental Philosophy lies here, that *Philosophical Chemistry* is the business of practically, or experimentally, examining into the internal Structure and Composition, not only of natural, but likewise of artificial and accidental Bodies; separating their constituent parts, differently combining these again, and thus producing new Concretes, and new modifying or changing both the internal or external forms of the old ones *; whereas the *Common Experimental Philosophy* is employed in the searching after and discovering the more obvious properties, and external uses of natural Bodies; the gross integrant parts, or entire aggregates, whereof it experimentally orders, arranges, disposes and applies, in their natural Form and Substance, to the promotion of Knowledge, and the uses of Life: but thus produces no new Bodies, nor enters into the Substance, Structure, and Composition of the old ones; nor changes their external and internal Forms; nor separates their constituent Parts; nor variously combines these afresh; nor regards bodies at all as they are resolvable and combinable, or as they are Simple, Mixts, Compounds, Aggregates or De-compounds: all which is the peculiar business and office of Philosophical Chemistry.

And from
Natural
Philosophy.

19. Thus again, 'tis conceived that *Natural Philosophy* cannot, with propriety, be said to extract and purify Metals, analyse Vegetable, Animal and Mineral Substances, tan Leather, brew Beer, dye Cloth, make Glass, produce Oils, Spirits, Soaps, &c. but these and all such are the direct and proper Operations of *Chemistry*.

So

* See Pag. 1.

So, likewise, Natural Philosophy discovers the obvious, external and general Properties of the Air, Fire, Water, Heat, Cold, Moisture, Wind, &c. by means of various Experiments, made with the Air-Pump and other suitable Contrivances; but it is *Philosophical Chemistry* which more intimately and essentially examines into the internal Nature, Structure, Composition, Relations and Uses of the Elements; and thence finds ways of applying them as Engines and Instruments of actual Business: and thus, in a more particular manner, it applies those two grand Instruments, *Heat and Cold*.

20. In short, there seems to be nearly the same difference betwixt *Chemistry* and the present *Natural Philosophy*, as there is betwixt *Art and Nature*; so that perhaps it might not be amiss, if, by way of distinction, *Universal Chemistry* were allowed to pass under the name of *Artificial Philosophy*. *The whole of Chemistry an Artificial Philosophy.*

21. This Distinction might not only serve to restrain *Chemistry* to its proper province, and settle a just notion of the real extent and immediate business thereof; but in some measure also contribute to remove the prejudice too commonly affix'd to the Name, and thro' habit apt to arise in the mind upon all occasions, when *Chemistry* is mentioned.

22. The immoral practices of many, who have taken up the name of *Chemist*, has greatly contributed to bring a disrepute upon the Art; whereto the abandon'd and the dissolute have usually made their pretensions with no more knowledge of it, than would serve them to cheat dextrously under its appearance. And so odious has *Chemistry* been render'd by this means, as to deter many from the due study and exercise thereof; whence it has been too much left in
bad

bad hands. But the damage from this Quarter is more sensibly perceived in the Sublimer Metallurgy; whence Golden Mountains having been too often seriously expected, the Indigent and the Knavish Pretenders to the Art, have hence been furnished with a fine handle to practise upon the Unwary, or such as they found actuated by superstitious Credulity, or blinded by an immoderate Passion for Gain: Insomuch that numerous and repeated Abuses, flowing from this Fountain, have occasion'd the instructive, and truly Philosophical Art of *Alchemy*, to be currently esteem'd as a juggle, or a trick on the one side; and as an Infatuation or Delusion on the other.

Whence its
farther ad-
vancement
retarded.

23. These, and the like abuses, are indeed no way justly chargeable upon the Art it self, but entirely upon the Artist; yet such is the fate of human Affairs, that the faults of Men are often laid at the door of the Arts they profess; as those Arts may prove occasional Causes of the Ill: whence *Chemistry* perhaps gives more occasions of public and private Abuses than other Arts; as being less generally understood, and attended with the prospect of larger Profits and Advantages.

24. But as the best things are capable of the greatest abuse, this mis-application of *Chemistry* could hardly, of it self, have removed it from the Care and Patronage of the *English* Philosophers, if more tempting Studies had not come in the way; particularly the higher Geometry, and speculative Philosophy: which of late seem to have employ'd most of our great Genius's. But if upon full examination these more sublime Studies shall be found of narrow use; *Chemistry* again may chance to be cultivated, as an Art whose Essence is Action, and whose End is Usefulness in Life.

25. And if the Genius of the *British* Philosophers should in earnest turn this way, the Art itself might thus be nobly rescued from the hands of such as dishonour it; and be set in its true light, unobscured by Chicane, Imposition or Delusion; new Improvements would be daily made therein; many valuable Secrets discovered; new Trades advanced; Commerce enlarged, and useful Knowledge increased. And tho' our Philosophers were to be thus employ'd for Ages yet to come, no fear of exhausting this rich Mine of Philosophy and Arts: which may be now dug to greater satisfaction and advantage, as there is no want of Mechanical Hands in *England* to execute in large, or bring into Works, such Discoveries as shall give the Encouragement. For, as much as the *English* Philosophers excel in Contrivance, Invention and Accuracy of Experiment, so much are our Mechanical People allowed to excel in adroitness and truth of Work. And since the new opening, draining and working of Mines among us, we seem to be call'd upon afresh to the exercise and improvement of this Art; whence it may in time come to meet with that esteem and application it deserves in a Country so justly famous as ours for its Philosophy and its Trade: and thence one day appear in a due Body and Form of *Artificial Philosophy*.

26. But such a Fabric cannot be erected without a number of Hands, set to work upon the several parts; and indeed all the assistance that can any way be procured, is little enough for the purpose. Nor is it easy to say, before some farther advancement is made, what materials and what helps are wanting to carry on the Work: It may not however be amiss here to point out some of the more immediate *Desiderata* for the farther application and advancement of
Philoso-

*Reasons for
the revival
of Chemi-
stry.*

*The assistance
required there-
to.*

Philosophical Chemistry; leaving the rest to be specified occasionally.

*Desiderata
of Philosophical
Chemistry;
with the
ways of sup-
plying them.*

27. (1.) And first, a method of facilitating the Experimental part of *Philosophical Chemistry* is greatly wanted; and may be supplied by the introduction of a *small Apparatus for an Extempore Philosophical Laboratory*.

The difficulties, inconveniences and encumbrance that attend the erecting, procuring and using the common Chemical Furnaces and Vessels, have been found a considerable discouragement to the exercise of this Art, in the way of Experiment and Inquiry; so that it might be of good service, if a *Philosophical or portable Furnace* were at all times easily procurable, for the ready and commodious performance of all the Operations in Chemistry; the Furnace, with its Apparatus of Vessels and Instruments, being made capable of standing, and working in a common Room, or Chamber, without danger. And whoever considers what has already been done in this way by *Glauber* and others, but particularly by *Becher* and *Vigani*, will not find reason to think such an Engine, and Apparatus impracticable.

Along with this general, portable Furnace, and just Apparatus of Vessels and Instruments, might go a suitable Collection of the more necessary and useful parts of the *Materia Chemica*, ranged under proper Classes; with their descriptions and more general uses: and thus all the preparatory Matters to the exercise of *Philosophical Chemistry*, might, without any farther trouble, be at once put into every one's hands.

28. (2.) In order to direct the more necessary Inquiries, it might be useful to have a *just Collection of all that is hitherto known and done in Chemistry* concisely drawn up, to shew the present state

state and condition of the Art with regard to what is delivered in Books. And this perhaps would be found an easier Task than it might at first appear: for tho' the Authors in Chemistry are exceeding numerous; yet the original experimental Writers, who alone are here to be regarded, are very few in comparison of the Speculative Theorists, Plagiaries and Transcribers. The more difficult and laborious part of the Work would be to collect from unwritten Traditions, and describe the daily Practices of mechanical Operators in their ordinary business of Smelting, Refining, Assaying, tempering of Steel, working of Glass, boiling of Sugar, preparing of Colours, refining Commodities, &c. all which require particular *Encheireses*, that the Workmen in most Cases studiously keep secret *.

29. (3.) There is farther wanting to the advancement of *Philosophical Chemistry*, a Set of *Practical Rules for conducting all the Chemical Operations, and teaching the Necessary Encheireses*. For tho' a Hand cannot by such Rules alone, without practice, be formed to business; yet the understanding may be directed by them to procure the habit in the best and shortest manner. And besides the usefulness of such Rules to those unacquainted with Chemical Operations, they may be of farther advantage to Persons of Experience; as the failure of particular Experiments, in particular hands, seems principally owing to a neglect or non-observance of particular *Encheireses*; which in delivering Experiments are sometimes omitted by design, and sometimes by neglect

* A good deal is already done towards this Collection in *Dr. Stahl's Philosophical Principles of Universal Chemistry*.

neglect or oversight. Thus the particular success of many Experiments in the sublimer Metallurgy, has at first been thought contingent; as those who endeavour'd to repeat them could not make them succeed: which has been afterwards found owing to in-attention, mis-conduct, or the want of a particular *Encheiresis*, in some part of the Operation. And this kind of failure will frequently be found in Chemistry, without a particular sagacity and dexterity, in the conducting of Experiments, or a deliberate and sober regard to *Encheireses*; which, in reality, make Operations and Experiments the things they are and ought to be.

30. (4.) Another thing wanted to the advancement of *Philosophical Chemistry*, is a *General List of the Chemical Desiderata, or Defects, in all Arts and Trades*; with suitable conjectures at the readiest ways of supplying them, upon solid and experimental Grounds. And to this might be added, by way of Appendix, a *List of Hints for the Introduction of new Mechanic Arts*; upon the like rational and solid Foundations: All which are a kind of Problems, the solution whereof naturally belongs to the *Philosophical Chemist*. Thus in the Iron-Works, for example, it has been a *Desideratum* to run Metal from the Stone without Bellows, another to make malleable Iron with Pit-Coal, and a third to work it, or soften it for the Hammer, without Fire. 'Tis a *Desideratum* in the Tin-works to get the Silver out of Tin, as 'tis now got out of Lead. In the Glass-works, 'tis a *Desideratum* to solder up the Cracks or Flaws in the Pots, whilst detain'd in the Fire; and another to make Glass without Veins, &c. A tasteless and inodorous Wine is wanted by the Vintner: and a tasteless and inodorous Spirit by the Distiller. The Painter wants

a permanent Green, and the Callico-printer a permanent blue Colour: and in short all Arts have their respective wants and defects. So *Chemistry* it self is greatly defective in an Experimental History of general Fermentation, separatory and combinatory, in Subjects of all the three Kingdoms; Putrefaction, Rancidness, Mustiness, Mouldiness, Glews, Mucilages, and a thousand things of the like general nature. In particular, the sublimer Metallurgy wants a more facile Method of extracting the Mercuries of Metals; and a cheaper one for Meliorations: and all the other parts seem equally defective.

The Hints for new Trades will rise occasionally, and almost without seeking. Thus 'tis natural from the common Operations of Brewing and Sugar-baking, to suggest that Sugar may be procured from Malt, and other Vegetables; that Nurseries of peculiar Ferments, native and foreign, may be rais'd, &c. The introduction of which new Trades would also greatly alter and improve the Arts of Brewing and Sugar-baking.

31. (5.) When a general Knowledge is gain'd in the Theory and Practice of this Art, so that its uses and manner of applying to the purposes of Life, are become ready and familiar; it seems principally necessary to its farther advancement, *That there should be a free Communication of Studies, Experiments and Trials, among a select number of Persons thus qualified:* For as it is naturally impossible that any single Man should have a competent Knowledge in all Arts and Sciences; so is it expedient, that as much thereof as can be acquired should be lodged in some few, who may freely draw out of each other as occasion requires. Whence they might be enabled to furnish out, not jejune repetitions

Of Technical Chemistry.

of things already currently known and practised : but results of new Inquiries, real Improvements, and methods of supplying the defects of particular Arts ; or Essays well fraught with experimental Facts, and useful Discoveries, after the manner of *Bacon*, of *Boyle*, of *Homburg*, and of *Stahl*. Nor will such a *select body* of men fail of procuring all the assistance that can be had from uncommon Books, Papers, and Accounts of particular Facts and Experiments ; even from such as relate to the making malleable Glass and Philosophical Gold, down to the little economical Observations of Spots and Tarnish. The search after the Philosophers Stone has produced abundance of curious, and some very profitable discoveries : and the vulgar observation of Iron-mould in Linen has given origin to a *fix'd* and durable Yellow in the business of Callico-Printing.

And in this manner *Philosophical Chemistry* should be kept continually open, or in a state of improvement ; only permitting, as it advances, that *Arts* and *Trades* be supplied, detached, or drawn from it occasionally.

S E C T. II.

Of TECHNICAL CHEMISTRY.

Technical Chemistry.

BY *Technical Chemistry* is understood the Application of *Philosophical Chemistry* to the immediate service of *Arts* ; so as to invent, form, assist, promote and perfect them.

Divided.

The *Chemical Arts* may be divided according to their Subject-matters ; or as they work upon animal, vegetable and mineral Substances :
whence

whence the whole of *Technical Chemistry* will fall under *animal, vegetable, mineral* and *mix'd Arts*.

To give a short view of the Method wherein *And treated* this Subject is propos'd to be treated, we shall here set down a few

Hints for the Improvement of certain
CHEMICAL ARTS: *And first for those*
exercis'd on SUBJECTS *of the*

ANIMAL KINGDOM.

Under
ANIMAL
ARTS.

I. *The Art of Preparing* SIZE and GLEW.

The Manner of dissolving the Leather, and boiling the Productions to their due consistence; with the ways of caking and drying the Glew. *viz. Size and Glew-making.*

The Manner of preparing fine *Glews* from Isinglass, &c. for particular Uses.

An Inquiry into the best Methods of preventing the loss of tenacity from the long boiling of the Glew.

The Use of *Papin's Digestor* in the making of *Size* and *Glew*.

An Attempt for preparing *Glews* from some cheap Vegetable Substances, without much heat.

The Manner of preparing and improving the fine Animal Glew, or Pocket-Soop.

The natural Disposition of all Animal and some Vegetable Matters for turning to *Glews*, shewn by Experiments; with a philosophical Inquiry into this Business, for laying the foundation of a Natural and Experimental History of *Glews*, *Mucilages*, *Ropiness*, *Viscosity*, *Siziness*, *Mouldiness*, &c. in animal and vegetable Liquors; but particularly the Blood, Saliva, &c. Wines, Vinegars, &c.

2. *The Art of Staining and Working of Horn, Bone and Ivory.*

Staining of Horn, &c.

The Ways of softening these hard animal Substances, so as to render them capable of Stamps, Figures and Embossments, by Moulds and Pressure.

The Chemical Preparations, Mixtures and Treatment required in this business, as to the giving a beautiful and fix'd Blue, Yellow, Red, Green, and other perfect Colours, to Bone, Ivory, and other Animal Substances.

The Methods of bleaching, whitening and staining of Hair, as depending on the same Foundation; or the ways of turning Hair of any colour at pleasure; but particularly from red to brown or black, from yellow to perfect white, &c. by means of Chemical Liquors, or chemical Fumes.

Ways of preventing the splitting and cracking of thin *Horn and Ivory-Wares*.

Hints for the more advantageous Use of the Horner's Shavings.

How far the Processes for staining Horn, Hair and Ivory are applicable to the staining of Leather, Wood, Stone or Marble.

The Experiments and Improvements in this Art applied to promote the Philosophy, or practical Doctrine of Light and Colours.

3. *The Art of Tanning.*

tanning.

The best manner of preparing the Hides and Skins of Animals, making the Tan-Liquor, putting them together, and drying the Subject.

The History of the principal Materials and Ingredients employed in this Art; their manner of preparing, extracting, condensing and preserving for use.

An Inquiry into some farther Uses of the Tan-Liquors, and the refuse Stuff, after the Operation is over.

The Application of this business to the *Art of Embalming*, or preserving the Flesh and other parts of Animals, for certain purposes, by a suitable Tan-Liquor and Drying.

The Use of this Art in explaining the nature of *Corruption* or *Putrefaction*, either in general, or at least in Animal Subjects; as it supplies a simple remedy to prevent it: and hence an Inquiry into the Methods of applying it to other useful purposes in Life.

4. *The Art of the Skinner.*

The best Ways of preparing and preserving *Skinnery*, the Skins of *Beasts* and *Birds*, with their natural Furs and Plumage.

How far this Art coincides with the Art of Tanning; and how far 'tis improveable by the Arts of Staining and Dying.

The usefulness of this Art in the business of *Anatomical Preparations*, and that part of natural History which more particularly relates to Animals.

5. *The Art of curing and preserving the Flesh* ^{*Preserving*}
of Animals for Food, both in a dry and a moist ^{*Flesh*} Form, or by Fumes, Salts, and Pickles; without indurating the subject too much, destroying its natural relish, or rendring it too saline.

The Improvements to be made in this *Art* by the due use of Sugar, Nitre and some diluted acid Spirits.

The *Dutch* manner of pickling Herrings, wherein their superior excellency depends.

The *English* manner of preparing Red Herrings, and the principal Methods used in our own

Country to preserve Provisions both at Sea and Land ; with various Improvements in these particulars, by the use of certain chemical or compound Liquors.

*Refining
Fats.*

6. The Art of *preparing, purifying and meliorating Animal Fats* ; as Tallow, Train-Oil, *Sperma Ceti*, &c. so as to render them fit for the finer uses.

Inquiries after some particular Methods of taking off the nidorous odour, and rankness of the grosser Animal Oils and Fats ; so as to render them sweet and fit, in some cases, to serve instead of Vegetable Oils and Wax.

Methods advanced for edulcorating *Train* or *Seal-Oil*, for the purposes not only of the Clothier, Soap-boiler, &c. but for the ordinary uses of Oil-Olive.

A particular Inquiry into the Method of purifying Butter by Separation, and converting it into a durable and perfect Sallad-Oil.

7. *The Art of Dying in Wool and Silk.*

PRELIMINARIES to this Art.

Dying.

(1.) An account of the *Materia Tinctoria*, Dying-Stuffs or Dry-Salters Wares ; with so much of their natural History as relates to this Business.

(2.) The various Ways of extracting the Tinging Parts of these Ingredients ; condensing, preserving and making them into Colours, ready for use.

(3.) The different Methods of preparing the Subject, according to its nature, and fitting it to receive the Dye.

(4.) The various Ways of discharging the Colours once given to Silks or Stuffs.

The ART itself.

1. The Ways of preparing the several Dye-Liquors for Blacks, Blues, Reds, &c. with the means of opening the Colours.

2. The Manner of applying the Subject to the Dye; with the particular *Encheireses* requisite to the full imbibing and fixing the Colour.

3. The Method of washing and treating the Subject when it comes out of the Dye.

4. Attempts for improving the several Branches of this Business; as Fulling, Scowring, Discharging, opening the *Materia Tinctoria*, condensing the tinging parts, fixing the Colours, and changing them so as to imitate the finest fix'd Colours of the *Indies*. With a particular Inquiry into the Methods of improving the Grain-Colours, and rendering them cheaper.

5. To consider how far this Art is applicable to the Dying of Leather, Feathers, Paper, Shells, &c. with its farther uses in natural History and Philosophy.

8. The Art of *Converting refuse or excrementitious Animal Substances to chemical uses.*

The Methods of preparing *Nitre*, *Sal-armo-niac*, and *Phosphorus* from these animal Matters. Turning refuse animal matters to use.

The Way of procuring *Nitre* in the *East*, and several *European* Countries: with an Inquiry whether it may be practised to advantage in *England*.

The Method of making *Sal-armoniac* in the *Levant*; with the ways of producing the same Salt to profit in other places.

The Art of making *Phosphorus* from Urine and other cheap excrementitious animal Matters.

Hints for the Improvement of certain
 ARTS exercised in the
 VEGETABLE KINGDOM.

1. *The Art of Timber.*

Timber.

The chemical Cause of the Decay and Rot-tenness in Timber; with the artificial means of preserving it sound, stopping the Rot, and killing the Worm.

An Inquiry into the best Methods of careening and *casing* of *Ships*, and preserving the Timbers from the injuries of the Sea.

The Methods of fitting Wood to endure long under ground, in watery places, or when exposed to the vicissitudes of the Weather.

An Attempt towards turning one Species of Wood into another, or making *Artificial Cedar*, from the more common sorts of Timber.

The Method of Bending large Timbers for the use of the Ship-wright, &c. with the ways of repairing the Damage they may receive in the Operation.

Tar, &c.

2. *Art of Resolving certain kinds of Wood by Fire*; viz. into Tar, Pitch, Turpentine, Oil of Turpentine, Rosin, Charcoal, and Pot-ash.

The Method of doing each of these to best advantage in different places; with an Inquiry how far they are practicable in certain parts of *England*, and our own Plantations.

A particular Inquiry into the whole Affair of Pot-ash; with the Ways of making it close, hard, and strong in *England*, and the Plantations; or nearly equal to that of *Russia*.

The different kinds of Pot-ash and Kelp of different Countries; whence their viciousness, strength,

strength, and other good and bad qualities; with the best and easiest Ways of proving their goodness, for the uses of the Soap-boiler, Dyer, Glass-maker, &c.

3. The *Art of Wax*; with the Method of *Wax*. Bleaching the common *Bees-Wax*, or turning it to *white Wax*; whence the Art of the *Wax-Chandler*, the several sorts of *Sealing-Wax*; and compound *Wax* for Stamps, &c. With an Attempt towards lessening the price of *Wax* in *England*; by the Introduction of certain new Substances, to answer the same ends.

4. *The Art of Bread.*

This Art consider'd in different Countries as *Bread*, practis'd upon various mealy vegetable Subjects.

The common manner of making *Bread* in *England*, compared with that of *France*, and other *European Nations*.

The Methods of improving the Art of *Bread-making*, by raising Nurseries of *Yeast*, or introducing new Means of preserving it fresh and sound.

The Art applicable also to subjects of the animal Kingdom, to good advantage in some cases.

5. *The Art of Starch and Powder.*

The common Process for Preparing *Starch*, *Starch*. from *Wheat-Flower*, by Fermentation.

The same Process applied to other mealy, and some glutinous, vegetable Substances; as *Potatoes*, *Rice*, &c.

The Method of reducing *Starch* to *Powder* of different kinds; with the adulterations and abuses commonly practis'd in this Art.

Inquiries into some more advantageous Uses of the *Starch-maker's Liquor*; and methods of shortening the Process.

6. *The*

An Attempt upon some profitable ways of preparing Vinegar without Wine, or the trouble of Brewing.

An extemporaneous way of making Vinegar.

The ways of recovering decayed Vinegar, or making it of any degree of Strength.

The Method of condensing Vinegar, or reducing it to its least volume.

An Attempt towards producing a solid Vinegar.

10. *The Art of Distillation.*

Spirits.

Improvements of this Art in its several Parts, viz. Brewing, Fermenting, simple Distilling, Rectifying, and Compounding; so as to make it answer the different Intentions of the Operator.

How to Brew in perfection.

How to raise Nurseries of Yeast, or preserve it long for the Malt-Stiller.

How to work with expedition, and how to greatest advantage.

How to make a clean Malt Spirit.

The Business of *Proof* in Spirits particularly examined.

The way of distilling Wine-Lees to great advantage.

The best Methods of rectifying all Spirits, recommended.

The best Form wherein to export and preserve Spirits, inquired into.

The best Ways of judging the Goodness and Purity of Spirits.

Inquiries into the best Acid, for giving a true vinosity to vulgar rectified Spirits.

The Ways of colouring Spirits, and fitting them for Sale.

The

The principal Uses of the common Spirits extended.

The History of Spirits, foreign and domestic.

The Method of turning common Spirits into Brandies or Arracks, undistinguishable from the foreign.

The true Method of working in compound Distillation.

11. *The Art of Sugar-making, and Refining.*

The common Process of making *Sugar* from *Sugar*, the natural Juice of the Sugar-Cane, philosophically and chemically considered.

Attempts for shortening this Process.

The whole Business of boiling Sugars to their proper height ; the more certain ways of taking of Proof, preventing of burning, and making the matter granulate to the best advantage.

An Inquiry after a Method of converting the *Melasses* or *Treacle* into tolerable *Sugars*.

This Art applied to Honey and other Vegetable Juices ; with a particular Inquiry if Sugar-Works might not be set up to advantage in Wine-Countries, and Countries productive of Corn, or certain Trees, that yield plenty of a saccharine Liquor by tapping.

The Art of refining the Sugar into the different kinds of Clay'd, Lump, Loaf, &c. with the Methods of different Countries, but particularly of *Germany* for this purpose.

Some Attempts towards discovering cheaper and more expeditious Ways of refining Sugars, and bringing them with ease to a perfect Whiteness.

To shorten the Process of making Sugar-Candy ; or to perform it without heat, and the Cockle-Room.

An

An Attempt to introduce several new and profitable Uses of Sugars, both in *England* and the Plantations.

12. *The Art of Soap.*

Soap.

The common Methods of making the different kinds of *Soap* in *England*, chemically consider'd.

To shorten the common ways of preparing the Lixiviums, and the long Operation of Boiling.

The Methods of making the hard Oil-*Soaps* at *Venice*, *Castile* and *Marseilles*; with attempts to produce as excellent in *England*.

To prevent or take off the rank smell of certain kinds of Soap, and give it any agreeable scent and colour.

An Attempt to perfect some extemporaneous Methods of making either solid or liquid Soaps.

An attempt to prepare and introduce certain Medicinal Soaps of uncommon virtues and uses.

The manner of making *mild Soaps* for the finest Lace and Linens.

13. *The Art of Tartar.*

Tartar.

The Method of producing *Tartar* from different Matters.

The vulgar Method of refining *Tartar* in *Languedoc*.

An Attempt to convert Red *Tartar* into White.

The best and most expeditious Ways of Refining or bringing it into what is vulgarly called *Cream of Tartar*; so as to make it perfectly transparent, and clear as well as white.

Hints

Hints for the Improvement of certain
MINERAL ARTS.

The Mineral Arts may be consider'd as they regard *Salts, Earths* and *Metals*.

The Art of Salt.

The best Manner of Working Salt from the *Salt*, Sea-Water, and Salt-Pits, in *France* and *England*.

The Uses of the Bitter Liquor of the Salt-Pits called *Bittern*.

The Ways of refining Salt both at home and abroad.

The Improvement of Salt-making by means of Congelation.

Some new Methods of obtaining Salt in its greatest purity and perfection.

The Art of Copperas and Vitriol.

The Processes of making the common *green Vitriol*, and *blue Vitriols* in their present state of Improvement; with an Inquiry into the best ways of shortening these Processes.

Attempts for an advantageous Method of converting green Vitriol into blue, or the Vitriol of Iron into that of Copper.

Some particular Uses of the Raw-Liquor of the Pyrites, before 'tis boiled into *Copperas*.

Uses of the refuse *Copperas*, or Cistern-Bottoms.

The Art of Borax.

A Philosophical and Chemical Enquiry into the origin, nature, and uses of this *Salt*, as found in the *East*, and thence brought into *Europe*, under the form of *Tincar* or *Tincal*. Whether it be a natural or factitious thing; with the man-

An Inquiry into the Methods of making the red and white Copper of Japan.

The more certain Methods of detecting Adulterations and Abuses in Metals.

The higher Art of Metals.

Alchemy.

Attempts for procuring the Mercuries of the several Metals, to profit.

A set of new Experiments to shew how far one Metal is transmutable into another.

Some Endeavours to fix common Mercury into a real metalline or ductile Matter ; and to soften the Regulus of Antimony.

The common Method of turning Iron into Copper examin'd.

Mr. Boyle's Method of transmuting Gold into Silver examin'd.

A summary View of the *sublimar Metallurgy* in all its parts ; with some particular Observations and Improvements upon such things therein as appear solid and useful.

The Art of Smithery.

Smithery.

This Art chemically considered in the hands of the *Gold-smith, Silver-smith, Copper-smith, Tinman, Pewterer, Plumber, and Iron-smith* ; with some Attempts for supplying their respective *Considerata*.

The Art of Foundry.

Casting.

To find the best Mixtures and Methods for casting large Ordnance, Bells, &c.

Inquiries into the most direct means of making the Metal run smooth, close and sound.

The common Business of Foundry in *Brass*, improved.

The

The Ways of casting Iron Guns, Stove-backs, &c. at the Iron Furnace, with a view to their Improvement.

The Art of Practical Mineralogy.

The chemical Methods of examining the various Mineral Bodies, to discover their Nature and Contents. *Examining Minerals.*

The principal Uses of such Bodies; as Cadmia, Arsenic, Mundic, yellow Zink, &c.

The various metallic Compositions to be made with them; and the manner wherein they affect and alter the perfect Metals.

Hints for the Improvement of certain
MIX'D CHEMICAL ARTS.

By *mix'd Arts* we understand those which are exercised upon Subjects of more than one Kingdom.

The Art of Paper, in Wool, Silk, and Linnen.

The common Methods of making the different *Papers*. kinds of Paper.

This Business considered with a Chemical View, in order to shorten and improve the Process.

The Methods of making the whitest Paper, and giving any kind of Colour thereto; with the usual Method of making that called *Marble-Paper*, and its Improvement, both at home and abroad.

Some Attempts to render Paper more durable, and less apt to be gnaw'd, or torn by Domestic Animals.

The State of this Art in *China, France, Holland and England.*

The Ways of Embossing and Printing of Paper for Hangings, &c.

Of Technical Chemistry.

The Application of this Art to the *Asbestos*, so as to make incombustible Paper.

An Attempt towards a Method of discharging the Printers Ink out of Paper.

The best Way of making *Filtring-Paper* for Chemical Uses.

The Art of Inks.

Inks.

Ways of preparing Inks of all Colours; solid and fluid.

Methods of discharging most kinds of Ink.

Ways of recovering the Colour of decay'd Ink; so as to render old and almost effaced Manuscripts legible.

The *Sympathetic Inks* chemically consider'd.

The *Printers Ink* improved.

The Ways of curing the Imperfections of the common *Writing Ink*; so as to render it undischageable; preserve it from ropiness, mouldiness, and being prey'd upon by Time, and Vermin, that would otherwise destroy the *Paper*.

The Art of Japanning.

Varnish.

The State of this Art in *England*; with its means of Improvement.

An Attempt to introduce the Amber-Varnish, so as to give a thick Coat of real *Amber*.

The Japanning of *Europe* compared with that of the *East*.

The Art of Glass.

Glass.

The common Processes for making the different kinds of *Glass*, chemically examin'd.

The State of this Art in different Countries.

The late Improvements in the Art of Glass carried still farther.

Attempts to prevent Veins in the finer Glass.

Attempts

Attempts to discover some Material for the Glass-house Pots, not subject to crack or flaw in the Fire.

The most probable Ways of stopping such Cracks, when they happen.

The Methods of staining and colouring Glass.

The Ways of imitating Gems in Glass.

Attempts to make Glass approach the hardness of the Diamond.

Attempts to mollify Glass, or render it in some Degree ductile or malleable.

Art of Pharmacy.

The present State of *Chemical Pharmacy* considered. *Medicines.*

How far it extracts, and how far it fails of extracting the specific Virtues of the *Materia medica.*

Attempts to introduce various new and effectual Methods of Treatment into this Art; with a view to procure the real Virtues of Simples, and render them specific.

An Attempt to regulate and ascertain the Business of Composition in this Art.

The Art of Pigments.

This Art chemically considered, in the hands of the *Dry-Salter, Colour-man* and *Painter.* *Pigments.*

The best and shortest Methods of preparing the several Pigments; as White-Lead, Red-Lead, the Lakes, the Blues, the Greens, the Reds, &c. with the ways of grinding, mixing, and fitting them for the Painter's Pallet, and other Uses.

Attempts to introduce several new kinds of artificial *Pigments.*

The Art of Fire-Works.

Fire-works. The best Methods of preparing Gunpowder, for its several Uses.

Attempts for making the whole parcel of Gunpowder take fire instantaneously in large Charges.

Some Attempts for the Improvement of Gunpowder, and increasing its Force : with the best Ways of preserving it from Accidents.

The whole Business of Fire-Works chemically consider'd.

Some Attempts for imitating the Phænomena of the Sun and fix'd Stars, by Fire-Works.

An Inquiry into the Chinese Method of Fire-Works.

The Art of Printing on Callico and Linen.

Staining. The usual Methods of preparing the Subject, laying on the Colours, or giving and fixing the Stain.

An Inquiry into the Durability, Nature, and Changes of these Colours; and the ways of discharging them.

The Ways of imitating the fine fix'd Reds and Blues of India.

The Chemical History of Stains and Mildews.

The Chemical History of Madder; and its Uses in this Art.

The several Colours at present used in Callico-Printing, how chemically prepared, and improved.

An Attempt to supply the Defects of this Art; by striking certain Stains, without the assistance of Alkali and Acid.

An Inquiry into the State of Callico-Printing in the East-Indies; and the Chemical Artifices there made use of for it.

The Art of Printing on Paper, with Metalline Types.

The best Ways of preparing, casting and *Printing*. working the mix'd Metal for the *Printers Types*; so as to give the Letter a full Face.

The most expeditious Methods of cleansing the *Forms*.

Attempts to improve the *Printers Varnish*.

Certain Attempts to discharge the *Printers Ink*.

Besides the various Arts of this kind, which seem more directly chemical, there are many others, capable of receiving improvement from *Chemistry*; and among these may be reckon'd Painting, Sculpture, Statuary, Architecture, Agriculture, Husbandry, Navigation, Astronomy; and all the practical Arts, both of Peace and War.

Upon a small Survey of the present State of the *Chemical Arts* in *England*, there appears to be room for the introduction of several new ones; and among others the following.

The refining of *Animal Fats*, for more curious Uses.

The making of *Sal-ammoniac* from Refuse Matters.

The improved Method of refining *Camphire*.

The refining of *Tartar*, into beautiful Crystals.

The compleating of *Borax*; or the perfect manner of refining *Tincar*.

The boiling down *Malt-Wort* to a TREACLE, for Distillation, Brewing, and Exportation.

New Art of *Brewing*, with cheap Materials.

New Art of WINES.

New Art of VINEGARS.

New Art of producing and rectifying SPIRITS.

The

The perfect imitation of *French Brandies*, and *Indian Arracs*.

The preparing of new *ENGLISH BRANDIES*, and *ENGLISH ARRACS*.

The raising Nurseries of *FERMENTS* of different Kinds.

The *Art* of recovering *eager Wines*, and *musty Drinks*.

New Manufacture of *WINE-LEES*.

The Manufacture of *White-Lead*, without *Vinegar*, *Horsedung*, or *Grinding*; or without prejudice to the Health.

The making of *English LIQUERISH*.

The making of *English OPIUM*.

The *Art* of *TEAS*.

New *Art* of *SNUFFS*.

The making of *OIL-SOAP*.

The making of *BLUE VITRIOL*.

The several preceding Articles are not propos'd as bare Hints, or superficial Glances at things, unwarranted by Experiments or Observation; but as a Prospect of some real Advantage to be rationally expected from a due Prosecution of this Subject.

S E C T. III.

Of COMMERCIAL CHEMISTRY.

Commercial
Chemistry.

BY *Commercial Chemistry* we mean the application of *Philosophical* and *Technical Chemistry*, to the founding, supporting, and improving of *Trades* and *Commerce*.

Its Parts.

In this View *Commercial Chemistry* will consist of three principal Parts, viz. (1.) The Exercise of all the *Chemical Arts* in such a manner as to supply

supply beyond the Demands of a single Nation, and afford a surplus of Commodities for Exportation, and foreign Consumption. (2.) The several Ways of condensing, curing, preparing, securing and fitting natural and artificial Productions, or Commodities, for Transportation and Carriage : And (3.) The means of supplying the Chemical Necessaries to Voyagers and Travellers, in founding, supporting and improving the Business of Trade, Traffic and Commerce in different Countries.

Hints for extending the CHEMICAL ARTS,
and rendering them COMMERCIAL *in*
ENGLAND.

This Subject is of too complex, and intricate How to be extended. a Nature to be adjusted from bare philosophical and chemical Considerations : a Knowledge of the different Policies, Laws, Interests, and Customs of Nations is here required ; or the joint Abilities of the *Statesman* and the Merchant. Thus perhaps it might not, tho' it were practicable, be the Interest of *England* to rival *France* in *Wines* and *Brandies* ; *Germany* and *Sweden* in *Metals* ; nor *Holland* in the Production of *Corn-Spirit*, and the cheap Preparation, and Refinement of certain other Commodities.

But supposing *England* at full liberty, and the Customs, Duties and Draw-backs in her favour ; then it is a Point of Philosophical and Chemical Consideration, to shew what Arts may be render'd commercial, for the Benefit of our own *Kingdom*. And among others of this kind may come the following, *viz.*

The Arts of *Wines* and *Brandies* ; from Grapes of *English* Growth.

Of Commercial Chemistry.

The same *Arts*, without *Grapes*, to still greater Profit; and practicable with much less Trouble and Expence.

The Art of producing *Corn-Spirit* to better Advantage than the *Dutch*; and under-selling them at the foreign Markets.

The Art of producing VINEGARS, cheaper than in *France* or *Holland*.

The Art of producing ARRACS, equal or superior in goodness to those of *India*.

The Art of REFINING CAMPHIRE to more Perfection, than the *Dutch*.

The Art of making HARD OIL-SOAPS, equal to the *Foreign*.

The Arts of curing several sorts of FISH and FLESH, to greater advantage than among the *Dutch*.

The Art of refining BORAX, to greater profit and perfection, than in *Holland*.

The Art of making WHITE-LEAD, to greater advantage, than in *Holland*.

It is not necessary to be large in the enumeration of many other *Chemical Arts*, no less improveable than these, for the purposes of Commerce; because a single one, when fully advanced and extended, may often prove the principal business of a whole COUNTRY; as the *Art of Wines* in *France*, *Spain*, and *Portugal*; the *Art of Sugar* in the Plantations; the *Art of Metals* in *Germany*, &c. And in this large View it is that Arts come to be consider'd under the Head of *Commercial*, as, in a less extensive way, they fall under that of *Technical Chemistry*; to which we therefore refer.

CHEMICAL CONSIDERATIONS *on the more perfect Ways of* CONDENSING *Commodities for Ex-* Commercial
Condensation. *portation, without impairing their Virtues, or lessening their Goodness.*

Before Goods are sent abroad, 'tis proper they should be reduced to the least volume they are capable of, without injury ; and put into a Condition of receiving the least damage from the Weather, Salt-Water, and other Accidents.

Thus Metals are transported instead of their Ores ; Sugar instead of the Sugar-Cane ; dry Raisins instead of Grapes ; High Spirits instead of Low-Wines ; Salt instead of Sea-Water, &c. with care to secure each Subject, that requires it, in a suitable Fustage, or Futail. And thus by means of *Commerical Chemistry*, different Countries are supplied with *Pitch, Tar, Rosin, Turpentine, Brimstone, Wax, Oil, Tallow, Tann'd Hides, Wines, Brandies, Salt, Sugars, Treacle, Paper, Books, Lead, Tin, Iron, Silver, &c.* whereby all Trade, Traffic, and Commerce is supported.

Hints for the History of COMMERCIAL
CONDENSATION.

The Method of *Condensing* WINES, so as greatly to lessen their Bulk, and at the same time improve their Virtue and Goodness, and render them much more durable, or less subject to change or decay ; either by *Land* or *Sea*.

The Way of *Condensing* MALT LIQUORS and VINEGARS for Exportation ; in the form of a rich fermented *Beer* or *Ale* ; not subject to spoil in the longest Voyage.

The Art of condensing all kinds of Spirits, Brandies, Rums, and Arracs, without losing of their natural Flavours.

The

Of Commercial Chemistry.

The Art of condensing the Juice of foreign *Grapes*, and leaving it fit to be made *Wines* in Countries that produce no *Wines* of their own.

Methods of reducing the *tinging Parts* of the more bulky *DYING-STUFFS*, to a kind of *Extract*; for *Dyers*.

The Reduction of *Pot-Ash*, *Tincar*, and *Borax*, to a less volume or weight; yet retaining all their essential *Parts*.

Hints for the History of COMMERCIAL CURATION.

*Commercial
Curation.*

The best Ways of curing Animal Substances; but particularly *Flesh*, *Fish*, and animal *Oils* or *Fats*, for *Exportation*, and long *Voyages*.

The best Ways of curing various Vegetable Commodities; as *Fruits*, *Woods*, *Gums*, *Hops*, *Tobacco*, and animal, vegetable, and mineral *Drugs*.

Hints for the History of COMMERCIAL PACKAGE.

*Commercial
Package.*

When Goods are cured and reduced to their smallest Bulk for *Exportation*, the next Consideration is the manner of *Packing* them up, and securing them to best advantage.

Goods are reducible to two Species, fluid and solid; according to the Nature whereof, they require a different Package: whence an Inquiry into the best Ways of securing *Oils*, *Wines*, *Brandies*, *Treacle*, *Malt-Liquors*, *Tar*, *Turpentine*, *Quicksilver*, &c.

An Inquiry into the best Methods of securing solid, but liquifiable Goods; as *Kelp*, *Pot-Ash*, *Sugar*, *Soap*, *Nitre*, *Vitriol*, *Borax*, *Alum*, &c.

The Methods of securing volatile and strong-scented Solids; as *Camphire*, *Musk*, *Afa-fætida*, &c.

to

to prevent their avolation, or affecting other kinds of *Goods*.

The best Methods of securing *TEAS*, and all fine *Goods* that are apt to catch and retain any heterogeneous Odour.

The best Ways of preparing Wrapping-Cloths for dry *Goods*; as the *East-India Wax-Cloth*, *Tutenag Canisters*, &c. the *English Oil-Cloth*, *Tarpawling*, &c.

Hints for a History of the Uses of Chemistry to Travellers, or in long Voyages at Sea, with a View to COMMERCE. *Chemical Apparatus for Voyages.*

The Necessaries for long, trading Voyages; as particularly a Chemical Chest; and a Portable Furnace; with a small Apparatus, consisting of a Screw-Press for Oils, Flux-Powders, Quick-silver, and Antimony, &c. for assaying of Gold, Silver, and Ores.

The more certain Signs of *MINES*; from the Chemical Examination of *Mineral Waters*, and the Evaporation of *Mineral Juices*.

The more expeditious Ways of assaying animal, vegetable, and mineral Substances; to shew what Proportion of valuable or merchantable Commodities they hold: illustrated in Oils, Essences, mineral Liquors, Drugs, Ores, and other mineral or metalline Matters.

Heads of Inquiries to be made by Travellers into the Chemical Productions of different Countries; as particularly into the manner of preparing *Arracs*, *Nitre*, *Borax*, and *Porcellane*; the curing of *Teas* in the *East*; making *Sal-Ammoniac* in the *Levant*; *Vitriol* in *Germany*; *Brandies* in *France*; *Pot-Ash* in *Russia*, &c.

An Account of certain *Chemical Contrivances*, capable of deceiving Travellers and Merchants in the condition of the Commodities; with the

the most expeditious Ways of detecting such Impositions; as the Sophistication of Wines, Brandies, Vinegars, and Arraes; the Debasement of Gold-Sand, Gold-Bars, or Ingots, Silver, Copper, and Tin, counterfeit Gems, &c.

The more certain, and expeditious Chemical Ways of discovering the Goodness, or Genuineness of most merchantable Commodities: with the best Methods of assaying *Pot-Ash*, *Tinical*, *Amber*, *Ambergrease*, *Musk*, *Opium*, *Aloes*, the natural *Balsams*, *Bezoar*, and various other kinds of *Drugs*.

The more ready Ways of examining whether unexperienced *Waters* be wholesome.

The best Methods of preserving *Fruits*, *Flowers*, and *Seeds* in their perfection, during a long *Voyage*.

The best Methods of preserving *Fresh-Water* at *Sea*.

The best and most expeditious Ways of edulcorating the *Sea-Water*, so as to render it potable, or fit for common Uses.

The best Methods of preserving fresh Provisions.

The best Pharmaceutical Methods of curing certain Diseases incident to Sailors and Travellers in long Voyages; and some particular Countries.

S E C T. IV.

Of OECONOMICAL CHEMISTRY.

*Oeconomical
Chemistry.*

BY *Oeconomical Chemistry*, is understood the Application of Philosophical, Technical, and Commercial Chemistry, to the particular Uses of a FAMILY.

Hence *Œconomical Chemistry* is of great extent; as bringing into practice, tho' in a small way, most of the larger Works of *Commercial* and *Technical Chemistry*: from the latter whereof, it differs only as that does from *Commercial Chemistry*; the first producing to serve a *Family*, the second a single *Nation*, and the third the *World*. *Its use and extent.*

This Branch of *Chemistry* may be consider'd with regard to the several *Offices* of a House, wherein, as in so many different Laboratories, 'tis usually practis'd; that is, with regard to the *Brew-house*, *Cellar*, *Store-room*, *Kitchen*, *Dairy*, *Laundry*, and their respective Stores, Furniture, and Apparatus.

Hints for the Œconomical History of FERMENTATION: or the Management of the BREW-HOUSE and the CELLAR.

The best *Methods* of brewing with *Malt*, for the service of a *Family*. *Oeconomical Fermentation.*

The Method of Brewing with *Honey*, for Mead, Metheglin, and a Liquor resembling *Canary*.

The Method of Brewing with *Treacle*, Sugar, and mix'd Matters.

The best Method of making *Cyder* and *Perry*; either simple, or by mixture.

The Method of Brewing with some particular *Vegetable Juices*.

Certain new Methods of making *particular Drinks*.

The Art of preserving *Yeast*, for some Months, fresh and sound.

The whole Business of making perfect and sound Wines of *English Grapes*.

The best Ways of imitating foreign Wines, without Grapes, or Raisins.

Of Oeconomical Chemistry.

The Art of MADE-WINES, with Raisins, or without, to great perfection.

Some Methods of curing foul and ropy *Wines*, and recovering eager *Drinks*.

The best Ways of defending a Vault or Cellar from *Frost*; and of restoring *Wines* or *Drinks* that have been frozen.

The Methods of preserving the *Casks* and *Brewing Vessels*, in their greatest Purity and Perfection: with certain Ways of recovering musty *Vessels*.

The best Method of erecting a Brew-house; so as greatly to lessen the Labour and Expence usually attending the making of *Drinks*.

The Art of *Vinegar* and *Verjuice*; from *Malt*, *Raisins*, *Wines*, *Cyder*, *Crabs*, &c. with the best Methods of making them durable, and preserving them at all times fit for use.

Hints for the History of the STILLATORY, and the STORE-ROOM.

The Family Stillatory and Store-Room.

The perfect Ways of making the most useful *Simple Waters*.

The best Manner of distilling *Spirits* from the Grounds of *Beer*, *Ale*, or *Wine-Lees*, for the service of the *Lamp*; and the making of *Compound* or *Cordial Waters*.

A Set of the most useful *Cordial Waters*, for the service of a Family; made either by *Distillation* or *Infusion*.

Certain easy and cheap Ways of imitating *French Brandy*, and *Indian Arrac*, for Family Uses.

The kind of Still most proper for oeconomical Purposes; with the Method of setting and working it to advantage; especially in large Families, and Gentlemen's *Country Seats*.

The best Methods of drying and preserving *Flowers*, *Fruits*, *Herbs*, *Roots*, and *Seeds*, for Family Uses.

The

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The Art of conserving Fruits and other vegetable Productions in *Vinegar*, or compound Pickles.

The Art of conserving *Fruits*, and vegetable Juices with *Sugar*; for the Table, and certain medicinal Uses.

The *Art of conserving* certain *Animal Substances* with *Salts* and *Sugar*, and acid *Fumes* or *Smoke*, for the Table.

Hints for a Chemical History of CULINARY ARTS.

To determine the best *Fuel* for *Kitchen* Culinary Arts. Use; and a Method for rendering it cheap, and inoffensive.

The most expeditious Methods of lighting a Fire.

The best Methods of preventing the Inconveniences arising from Smoke and Soot in a *Kitchen*.

The Art of edulcorating the refuse Fat of a *Kitchen*, for Lamps, or other oeconomical Uses.

The manner of introducing the *Balneum Mariæ*, and *Papin's Digestor*, into the *Kitchen*; with their Advantages.

The best Methods of preserving all the metal-line Furniture of a Kitchen from *Rust* and *Tarnish*.

The Method of expressing Sallad-Oils from various Seeds; but particularly from the Seed of *Mustard*.

The Method of making the finest *Salt* for the *Table*.

Hints for the Chemical History of the DAIRY.

The Chemical History of *Milk*, and its different Parts.

Methods of procuring the largest Yield of *Arts of the Dairy.* *Dairy Productions.*

Of Oeconomical Chemistry.

The Chemical History of *Rennet*; and some certain vegetable Acids in the making of *Cheese* and *Butter*.

The proper Application of Cold, Heat, Rest, and Agitation in the Business of the DAIRY.

To determine the best kind of *Vessels* and *Uten- sils* for the DAIRY.

Ways of flavouring and colouring these Pro- ductions to any particular Taste, or Fancy.

Hints for the Chemical History of the LAUNDRY.

*Arts of the
Laundry.*

The best Family Methods of making SOAPS, for different kinds of Linen and Laces.

The best Family Ways of preparing the finest BLUES and STARCH.

The best Methods of taking Spots, Stains, Iron-moulds, Mildew, &c. out of *Linens*, and *Laces*.

The Art of *Bleaching*, or whitening of Linen.

The Method of softening hard Waters; or making them fit for the Uses of the *Laundry*, *Dairy*, and the *Kitchen*.

Hints for the Chemical History of certain Pleasurable, or Profitable ŒCONOMICAL MATTERS.

*Various Fa-
mily Mat-
ters.*

An Account of several curious and useful Œco- nomical Experiments.

To preserve *Paintings*, and all kinds of *Furni- ture* within doors.

To preserve *Wood-Work* exposed to the Wet, and Weather.

The History of *Manures*, and the best Ways of preparing Grain for the Ground.

To render potable *Liquors* cool and pleasant in the *Summer*; or in hot *Countries*.

To find pleasant and profitable Substitutes for TEAS in *England*.

The

The Ways of procuring grateful *Odours* in particular Rooms, or large *Assemblies*.

The Ways of exhibiting many curious chemical *Phænomena* at public Entertainments.

The Ways of extracting Gold and Silver out of base Materials.

Thus we have lightly touch'd some principal Heads, under which we purpose to consider *Chemistry*, with a view to its farther Advancement in *England*. And hence, 'tis conceiv'd, may be derived a general Notion of the Art ; which, in so comprehensive a View, we would call *UNIVERSAL CHEMISTRY* ; on account of its extensive Usefulness in human Affairs.





A N
E S S A Y

Upon the BUSINESS of
DISTILLATION:

O R,

The Best METHODS of Producing,
Rectifying, and Compounding
Inflammable Spirits, according to
the Ends they are intended to
answer.

W I T H

A View to Improve the several Branches
of this Art, in the Hands of the *Malt-
Stillers, Rectifiers, Compounders, and Apo-
thecary*

ADVERTISEMENT.

THE Purport of this little Piece is practically to unfold and apply the *Doctrine of Distillation* ; not so much by relying upon what others have done, as by attempting to improve and enrich the *Art* with some new Hints and Discoveries.

'Tis wrote in pursuance of the preceding *Scheme*, for the advancement of various *Chemical Trades*, that lay the Foundations of *Artificial Philosophy* ; and publish'd as a Specimen of the manner wherein the Author would gladly see many other *Chemical Arts* treated, in execution of his general Design.

But such a Work being very unequal to the Abilities of a single Person ; the Assistance of those that approve the Undertaking is earnestly requested.

The Attempt will proceed, as in weak Hands it may, whether any Assistance be received, or not ; but if the Author should happily find some useful Hints left with his Bookseller, the Work might thence be animated, Arts farther improved, and some new ones invented for the Benefit of Mankind.

An ESSAY *upon the*
Business of DISTILLA-
 TION, &c.

Common Distillation is the way of separating inflammable Spirits from prepared Vegetable Matters, by means of the *Vefica*, *bot Still*, or *Alembic* ; with its proper *Worm*, and *Refrigeratory*.

But as no *Vegetable Subjects* are capable of affording ardent Spirits, without *Brewing* in many cases, and without *Fermentation* in all ; 'tis necessary that these Operations be previously considered, as the *Foundations of Distillation*.

S E C T. I.

The Business of Brewing, as it relates to the Production of Brandies, or
 INFLAMMABLE SPIRITS.

1. **B**Y *Brewing* is meant the Method of extracting the more soluble parts of Vegetables, with hot Water ; which thus becomes a *Tincture*, *Solution*, or *Decoction*, disposed and fitted for *vinous Fermentation*.

*The Subjects
best fitted
for it.*

2. Such a *fermentable Solution* is obtainable from any Vegetable whatever, under proper Management and Regulation; but the more readily and perfectly the Subject dissolves, the better it is disposed for Fermentation, and the Production of Brandies. Thus *Sugar, Honey, Treacle, Manna*, and other inspissated vegetable Juices, which totally unite with Water, into a clear and uniform Solution, are more immediate, more perfect, and better adapted Subjects of Fermentation, than Roots, Fruits or Herbs in Substance, the Grains, or even Malt itself: all which dissolve but very imperfectly in hot Water.

*Malt commonly chose
for cheapness.*

3. Yet *Malt*, for its cheapness, is generally preferred in *England*; and brewed for this purpose, much after the common manner of brewing for Beer: only the worst Malt is usually chose for Distillation; and the Tincture, without the addition of Hops, and the trouble of boiling, is here directly cooled and fermented.

*The advantage of
Malting.*

4. The *Grain* intended for Brewing, is previously *malted*, to prepare it for dissolving more easily and copiously in the Water; so as to afford a richer Tincture, or Solution: which after due Fermentation, will yield about one half more of *proof Spirit*, than the Tincture of an equal weight of unmalted Corn. Whence we may understand the difference betwixt the *Starch-makers Liquor*, and the *Distillers Wash*, as they phrase it.

*Malted
Corn, how
brewed to
advantage.*

5. To *brew with Malt* in the most advantageous manner, 'tis requisite, (1.) That the Subject be well prepared: (2.) That the Water be suitable and duly applied: and, (3.) That some certain additions be used, or alterations made, according to the Season of the Year, or the Intention of the Operator.

By

By an exact regulation in these respects, all the fermentable parts of the Subject will be brought into the Tincture ; and thus become fit for Fermentation.

6. The due *preparation of the Subject* consists The Subject, how prepared by malting. in its being *justly malted*, and well ground. When the Grain is not sufficiently malted, 'tis apt to prove hard and flinty, so that the Water can have but little power to dissolve its Substance ; and if it be too much malted, a part of the fermentable matter is lost in the Operation.

7. The harder and more flinty the Malt, the How by fine grinding, with the advantage thereof. finer it ought to be ground ; and perhaps in all cases, when design'd for Distillation, it ought to be reduced to a kind of coarse Meal. For 'tis found by experience, that if it be ground thus fine, good part of the trouble, the expence, and the time usually consumed in Brewing, may be saved ; and a greater Yield of Spirit procured. For thus the whole Substance of the Malt may all along remain mixed in among the Tincture, and be fermented and distilled along with it : which is a particular that deserves the attention of the *Malt-Stiller* ; as he principally consults dispatch, and making the most of his Subject, without solicitously regarding the purity and perfection of the Spirit.

8. The Secret depends upon thoroughly mixing, or briskly agitating and throwing the Meal about, first in cold, and then in hot Water ; and repeating this brisk agitation after the fermentation is over : when the thick turbid wash being immediately committed to the Still, already hot and dewy with working ; there is no danger of burning, unless by Accident, even without the farther trouble of stirring : which in this case is found needless ; tho' the quantity be almost ever so large, provided the requisite care and clean-

cleanliness be used. And thus the Business of brewing and fermenting may very commodiously be perform'd together ; or reduced to one single operation *.

*How by
sprinkling
with saline
Solutions.*

9. There are some also, who, the better to *prepare their Malt*, sprinkle it before grinding, with an aqueous Solution of Nitre, or common Salt : for the same purpose others use Lime-water ; which seems not so well adapted, if the design, besides preventing the avolation of the finer flower in the grinding, be to promote the Fermentation, increase the quantity of Spirit, or add to its pungent, acid vinosity.

*The Water,
how to be
chose for
brewing.*

10. The best or most profitable *Water* for the purpose of brewing, is that of *Rain* ; as being not only very thin, soft, and thence well fitted to extract the Tincture of the Malt, but also abounding in fermentable Parts ; whereby it quickens the Operation, and adds something to the Yield of the Spirit. Next to this is that of Rivers or Lakes, especially such as wash any large tract of a fertile Country, or receive the Sullage of populous Towns ; especially if taken up near the place where great Brewing or Distilling Works are constantly carried on.

11. But where neither of these Waters are commodiously procurable, or only a hard, aluminous, or vitriolic Spring-water is to be had ; this may be made fitter for the purpose, either by laying a chalk bottom, for it to run upon ; or by adding some particular Preparation to a parcel of it, after it is pumped. A prudent use of Quick-lime and fixed Alkali, will in such case be of service, and precipitate the offending mineral Matter. There are also other simple Preparations, and some Compositions made with the Liquor of calcined
Flints,

* For farther Directions as to this new Method, see pag. 61.

Flints, &c. that answer this end still better ; but they come too dear to be used in that quantity they are here required.

12. Whatever *Water* is made choice of, it How to be applied. must stand in a hot State upon the prepared Malt; especially if a clear Tincture be designed : but a known and very considerable Inconvenience attends its being applied too hot, or near to a state of boiling, or even scalding, with regard to the Hand.

13. To save time in this case, and prevent running the Malt into Clods or Lumps, the best way is to put a certain measured quantity of *cold Water* to the Malt first ; and stir that very well in with it, so as to form a kind of thin uniform Paste ; after which the remaining quantity of *Water* required, may be added, in a state of *boiling*, without the least danger of making what, in the Language of Distillers, is termed a *Pudding*. And thus the proper or precise degree of heat, necessary to extract the full virtue of the Malt, with all advantages, may be very expeditiously hit, or assign'd, to a great exactness ; as the heat of boiling *Water* is a Standard, which may at once be let down to any desired Point of warmth, by a proper addition of *cold Water* ; due allowance being made for the Season of the Year, and the Temperature of the Air. And this little obvious Improvement, applied to the Method just above hinted, for reducing *Brewing* and *Fermentation* to a *single Operation* *, will render it practicable to considerable advantage.

14. The quantity of the *Water* employed must In what quantity. be suited to that of the Malt : the Rule is, that a clear Tincture, or turbid Mixture be made so dilute and thin, as to ferment with ease and expedition,

* See Pag. 60.

pedition, yet not needlessly increase the Bulk of the whole. Too little Water makes a viscous, clammy Tincture or Mixture, scarce at all disposed to ferment, before 'tis let down lower with *Water*; nor can the *Water* so clogged extract all the soluble parts of the *Malt*: on the other hand, when the Tincture is too thin and aqueous, it takes up too much room, and adds to the trouble and expence of all the parts of the operation. A due Medium therefore is here to be chose: And in general, the Goodness or Richness of the Malt-Stillers *Wash* should be much the same as of the weakest *French Wines*, or that ordinarily design'd by the Brewers of *London* for ten Shilling Beer. But if a more exact Standard is required, recourse must be had to the Essay-Instrument, Water-Poise, Hydrostatical-Balance, or other Methods of trying the Strength of Solutions, and finding their specific Gravity or Tenacity: which afford a surer Rule than that obtain'd by weighing the Malt, and measuring the Water; because of the different goodness of different parcels of Malt, and the accidents of the Operation. But if a fine Spirit be the thing in view; 'tis much better to make the *Wash* too weak, than in the least too rich.

*And with
what cir-
cumstances.*

15. Under the right Application of the *Water*, must also be considered the proper manner of agitating the Mass; so that all the Parts of the aqueous Fluid may come fully and frequently in contact with all the soluble particles of the Subject: and when once the Water is thus well saturated, by standing the proper time, it is to be drawn off, and fresh poured on; and the agitation repeated, till at length the whole virtue, or saccharine sweetness of the Malt is extracted; and nothing but a fixed husky Matter remains behind, incapable of being farther dissolved by the
the

the action of hot or boiling Water ; or of being advantageously washed, or rinsed by the bare affusion of cold. This artificial and external agitation is requisite, as well in the ordinary way of brewing, as the shorter above-mentioned ; and may to advantage be repeated more than once in both cases, towards the beginning of the Operation, and at each affusion of fresh Water ; but especially in the short Method which has a great dependance thereon *.

16. The *Difference of Seasons* is found to require some alteration in the direction and management of the business of *Brewing* : thus it is particularly found necessary to use the Water colder in the Summer, than in Winter ; to cool the Tincture suddenly in close sultry Weather, lest it should turn eager ; and to check the too forward disposition which Malt has to ferment, when the Air is hot, by a suitable addition of unmalted Meal ; which being much less disposed to Fermentation than Malt, thus helps to * restrain and moderate its impetuosity, so as to render the Operation suitable and effectual to the Production of Spirit ; that might otherwise, in great measure, be dissipated and thrown off by an over-hasty and violent Fermentation ; especially when the warm Air is suffered freely to come at the fermenting Liquor. Others, for the same purpose, use Rye-meal ; but this gives the Spirit a most disagreeable and nauseous Flavour ; not easily to be got off or altered to advantage, by any known method of Rectification.

17. It has likewise been thought of service, in general, or at some particular Seasons especially, to *acidulate the Water* employ'd in Brewing, with a small proportion of some vegetable, or light

* See Pag. 60.

light mineral acid; which is supposed to curb and regulate the Fermentation of the Tincture, improve the acid vinosity of the Spirit, and occasion some small increase of its quantity; and with the same view, common Salt, Nitre and Tartar have likewise been employ'd in the manner hinted above*.

And particular intentions require particular additions.

18. The particular Intention of the Operator may render various other Additions necessary; Thus some, to improve the Tincture, and dispose it to yield more Spirit, or to give it a particular Flavour, add strong and pungent *Aromatics* in the *brewing*; chusing the cheapest for this purpose, such as *Gran. Paradis. Cort. Winteran. Ginger, &c.* But in the common way, 'tis to be fear'd these Additions do not effectually answer the Intention; because a particular Encheiresis is requisite to make the Practice advantageous†. Upon this Foundation stands a very instructive Method, used abroad for preparing *Geneva ab Origine*, by mixing the bruised Berries of the Juniper among the Malt, and brewing them together; whence they procure a compound Tincture, which by Fermentation and Distillation, affords a Spirit much more intimately and homogeneously impregnated with the fine Essence of the Berry, than that prepared in the common way of Distillers.

The inconveniences of brewing with Malt, how remedied.

19. The *Inconveniences that attend the Brewing directly with Malt*, are very considerable; the Malt being of a very large Bulk in proportion to the soluble, saccharine, or truly fermentable Parts it affords; whence numerous large Vessels, much Labour, and consequently great Expences are required to conduct and manage such a Business in the large way. The Remedy here, as
in

* See Pag. 60.

† See this farther considered in the next Section.

in all other cases, may be much easier started than effectually applied. However, the Foundation for it seems to rest in practically reducing the perplexed Business of the *Malt-Stiller*, to the simple Business of the *Fine Stiller*; or in other Words, in reducing *Malt* to a *Treacle*. The thing in itself may be done to perfection; but how, in the large way, it will answer as to Expence, must be left to those who think it worth their Care to consider. The Experiment is no more than this; when a parcel of *Wort*, brewed in the common manner, is become fine by standing; let it be decanted clear, and directly boil'd in a common Copper, till it begins to inspissate, or change a little towards a brown or dusky Colour: at which time it must be directly emptied, into a *Balneum Mariæ*, where it may be exhaled to the full Consistence of Treacle; which is a proper Form to preserve it in, till occasion calls for it.

20. If the Operation were finished in the Copper, the Matter would be in great danger of burning, or unavoidably contracting an *Empyreuma*, that could scarce ever be got off again; whence the whole might come to be absolutely unfit for the purpose: or if it escaped this accident, it would still, through the Unsuitableness and Violence of the Heat, or Fire, now acting immediately upon the containing Vessel, be greatly indisposed to ferment; so as if it fermented at all, not to yield one fourth of the Spirit the *Wort* itself would otherwise have afforded*.

21. But if the operation be dextrously and carefully performed, (which perhaps is not quite so easy a thing as it may at first seem) the Saccharine Matter, tho' of as full a body, will be abundantly

* See this Subject farther touched, pag. 69, 70.

dantly paler than Treacle, a little more glutinous, very sweet, pleasant, and finely bitter, tho' no Hops were used in the preparation. In this state it will keep long, without any alteration; and remain capable at all times of being brought back by water, to a *Wort* again, that will ferment fully, and yield a Spirit after the manner of Treacle. *Glauber* and *Becher* have both aim'd at some such thing; but neither of them brought it to perfection. Nay, *Becher*, after a whole year spent in the enquiry, with a view indeed to Wines as well as *Malt Liquors*, publickly declares, he could by no means credit what *Glauber* says about it; and offers a round reward to any one, who should possess him of the Secret *.

22. If upon full Experience this method shall be found advantageously practicable in large; plentiful years, convenient situations, proper helps, &c. may be pitched upon for setting up a new *Trade of Treacle-making*, for the *Distillers* at least; if it shall not be found farther practicable, to turn this new Treacle into potable Liquors or *Sugars*: which might possibly, under due regulation, lay the Foundations of a *Work*, not unlike the Sugar-works of our Plantations; tho' manageable with abundantly less trouble and expence.

23. *Such Grain, or Pulse, as cannot be commodiously malted* by the common methods, hitherto known and practised; may be boil'd in water, instead of being brew'd. Thus the *Indians* dissolve their Rice into a thin pap or jelly by boiling it with water; and afterwards ferment it into a potable Liquor or Wine, which they preserve under ground for many years successively. And in the same manner may the *Virginia Wheat*, or *Indian Corn* be treated; till the ingenious way of
malting

* See *Physic. Subterranean*, *Becher*, Sect. V. de *Fermentatione*. Cap. II.

malting it, by sowing it in the ground, and there suffering it to sprout, be more generally known, and brought into practice. But this indisposition scarce affects any of the *English* Grains, which are now usually malted to advantage. Tho' *Buck-wheat* perhaps remains still to be experienced; and how far a particular method of malting may tend to alter the very disagreeable flavour of *Rye*, seems not hitherto generally known.

24. All other Vegetables intended for *Brewing*, The business of Brewing, how shortened. should, as much as possible, have their fermentable parts prudently reduced to the state of a *Treacle*, *Sugar*, or *inspissated Juice*; not only for the sake of preserving them perfect, but for the greater ease and convenience of working. Thus the *Juices of various trees*, as particularly the *Birch*, the *Sycamore*, &c. are readily boiled up to such a treacly, or saccharine Substance. And in the same manner, where it is worth the labour, the juices of all *sweet Roots*, *Fruits*, *Canes*, *Plants*, &c. might be thickned and preserved.

25. When once the fermentable parts of Vegetables are thus concentrated, and brought together into a small compass, the business of Brewing becomes very facile; as being now no more than mixing, dissolving, or sufficiently diluting the inspissated Juice with lukewarm water: whence the Solution, either alone, or with additions, is now perfectly fitted and prepar'd for *Fermentation*.

S E C T. II.

The Business of Vinous FERMENTATION, and the raising and preserving of FERMENTS ; so far as relates to the Production of VINOUS SPIRITS.

Fermentation, what.

1. **B**Y *vinous FERMENTATION* is understood that physical action, or intestine commotion of the parts of any of the preceding Vegetable Tinctures, or Solutions, which fits them to yield an inflammable Spirit upon *Distillation*.

That of the Distiller differs from the common.

2. This *Fermentation* under the hands of the Distiller differs from the common, which is used in the making of potable Malt Liquors and Wines; as being much more violent, tumultuary, active, and combinatory than that. A large quantity of ferment or yeast is here added, the free Air is admitted, and every thing contrived to quicken the operation; whence it is sometimes precipitately finished in the space of two or three days.

Its inconveniences.

3. This great dispatch has its great inconveniences with regard to the Spirit, which hence becomes not only fouler, or much more gross and really terrestrial, than if the Liquor had been slowly fermented; but also suffers a diminution in its quantity, from the violent and tumultuary admission, conflict, and constant agitation of the free Air in the body, and upon the Surface of the Liquor; especially if not immediately committed to the Still, as soon as the Fermentation is fairly slackened or fully ended.

4. 'Tis a difficult Task to render the business *Difficultly removed to profit.* of *Fermentation* at once perfect and advantageous. To ferment in perfection, of necessity requires length of time, proper attendance, and close vessels; besides several particular *Encheireses* and contrivances, which one cannot reasonably expect should be received and practised in the large way of business, on account of the charge: unless it could be made appear, as there is some reason to suspect it may, that the increase in the quantity of Spirit, (not now to mention the improvement of its quality) might be brought to pay the additional expence: But it requires farther experience to reduce the thing to a certainty. In the mean time, it may not be amiss to try how much of the more perfect Art of vinous Fermentation, is profitably practicable by the Distiller, in the present circumstance of things.

5. The Improvements to be made in this affair *Attempts to remove them.* will principally regard; (1.) *The Preparation or previous Disposition of the fermentable Liquor.* (2.) *The Additions tending to the general, or some particular end.* (3.) *The Admission or Exclusion of the Air.* (4.) *The Regulation of the external Heat or Cold.* And, (5.) *A suitable degree of Rest at last.* When proper regard is had to these particulars, the liquor will have its due course of Fermentation; and thence become fit to yield a pure and copious inflammable Spirit by Distillation.

6. It has been already observed, that the Tincture, *By making the Liquor dilute.* Solution, or Liquor design'd for Fermentation and the Still, should be made thin, or very considerably aqueous; as this property not only fits it to ferment readily, but also to yield more of a pure vinous Spirit in proportion, and part with it easier in distillation, than if it were richer, more glutinous, or clammy: The gross, foul, viscid, and earthy particles of

such glutinous Liquors, being after Fermentation apt to rise with the boiling Heat employ'd to raise the Spirit; which thus of course comes over foul and fetid. There is another Advantage attending this thinness of the Liquor; viz. that it will the sooner fall fine, by standing, before Fermentation: whence it may be commodiously drawn off from its Fæces, or Bottom; which must always, in case of Corn, Malt, or other Mealy Substances, be kept out, where the Purity of the Spirit is consulted.

*And of a
due Warmth.*

7. A certain degree of *Warmth* seems requisite, in the Northern Climates, to all artificial Liquors intended for immediate Fermentation, especially in the Winter: but the natural Juices of Vegetables that have never been inspissated, as that of Grapes, and other Fruits, when fully ripened, will usually ferment as soon as they are express'd, without any external Assistance. But as a certain degree of Inspissation prevents all tendency to Fermentation in vegetable Juices, otherwise strongly disposed to ferment; so a long Continuance or Increase of the inspissating Heat, especially if it acts immediately through a metalline or solid Body, upon the Juice, will destroy its fermenting Property; and this the more effectually, as the Heat employ'd approaches to that of scorching, or the Degree capable of giving an *Empyreuma*; according to what was hinted above, with relation to *Wort* in particular*. After the same manner, several Experiments make it appear, that there is a certain degree of Heat; the continuance, or least increase whereof, proves detrimental, or destructive to Fermentation; as there is another that wonderfully encourages and promotes it. These two degrees

* See pag. 65, 75.

degrees of Heat, ought to be carefully noted and settled by the Thermometer, or other more certain Method, for philosophical and chemical Uses; but for common, or œconomical Occasions, they may be limited to what we usually understand by a *tepid* and a *fervid* Heat: A *fervid* Heat is the Bane of all vinous Fermentation; as a *tepid* one, or rather an imperceptible Warmth, is the great promoter thereof. In this neutral state therefore, with proper contrivances to preserve and continue it, the Liquor is to be put into a suitable Vessel for Fermentation; at which time, if it work not of itself, it must be quickned by additions; and in general, by such things as are properly called *Ferments*.

8. By *Ferments* is here meant any Matter, which, put to a rightly disposed Fermentable Liquor, will cause it to ferment much sooner, and faster, than it would of itself; and thus greatly shorten the Operation. Those are called *Ferments* in an abusive sense, which, when added to the fermentable Liquor, only correct some fault therein, and thereby fit it to ferment the better, yield the more Spirit, or give some particular Flavour.

By improving the business of Ferments.

9. The primary use of *Ferments* therefore, is to save time, and make dispatch in business, whilst they only occasionally and accidentally give a flavour, or increase the quantity of Spirit. And, accordingly, all fermentable Liquors may, without the least addition, and only by a proper management of Heat, be brought to ferment, more perfectly, tho' more slowly, than with the assistance of *Ferments*.

10. These *Ferments*, in general, are the Flowers and Fæces of all fermentable Liquors; generated and thrown up, or deposited, either in the Fermentation itself, or after the Operation is finished.

be conceiv'd; as opening not only a new Scene in the Business of Distillation, but also some other Businesses depending upon Fermentation. The Benefit of it does not, however, extend to *Malt*, treated in the common way; nor to any other Subject but what affords a Spirit tolerably pure, and tasteless: as it otherwise makes not a simple, pure, and uniform, but a compound, mixed, and unnatural Flavour. How far the *fine Stiller* may apply it, well deserves his Consideration; and whether our native *Cyder-Spirit*, *Crab-Spirit*, &c. which have little Flavour of their own, may not by this Artifice, or a little farther Improvement of it, be brought nearly, or intirely into the State of some highly esteemed foreign Brandies, is recommended to Experience.

*In what
quantity to
be used.*

16. When the proper *Ferment* is thus pitch'd upon, suitable to the Design; its *Quantity*, *Quality*, and *Manner of Application*, are next to be considered.

Its *Quantity* must be proportioned to that of the Liquor, its Tenacity, the degree of Flavour it is intended to give, and the dispatch required in the Operation; from which Considerations, every one will form a Rule to himself: But till such a Rule is obtain'd, or in order to obtain it, proper Trial will shew how much suffices for the purpose; beginning with a little, and observing to add more occasionally; the Weight of the whole being noted before-hand. *Treacle* is found to require a large Proportion of *Ferment*; and even sometimes needs the assistance of other Additions. Indeed the manner wherein this inspissated Juice is obtain'd, tends greatly to unfit it for Fermentation. The Strength, long continuance, and almost immediate Contact of the Fire in *Sugar-making* and *refining*; and the frequent use of Lime, or other alkaline or terrestrial Bodies, so condense, indurate, and scorch the Body
of

of this Juice, and absorb its Acid; that one would scarce expect it should ferment at all; even with the addition of *Falap*, or other powerful, saline, and acid, or acrid Stimulators; which tend to break the viscous and adust Connexion, or strong Combination of its Particles*.

17. More Circumspection is necessary, with regard to the *Quality of the Ferment*, if a pure Spirit be required; for in case of the least Mustiness, or Corruption, which all *Ferments* have a strong and natural Tendency to, unless carefully cured and preserved, it may deeply impress itself, and communicate a finewy or fetid, nauseous and cadaverous Smell and Taste to the whole Body of the Liquor and Spirit. Great Care is therefore required, that the *Ferment* be perfectly fresh, and fragrant, nor in the least inclinable to Acidity, or Eagerness; which might prevent its rising, or forming a head, and give the Liquor an acetous, instead of a vinous Tendency.

18. When thus the *proper Quantity of a good-conditioned and suitable Ferment* is got ready, it must be put to the fermentable Liquor in the bare tepid, or scarce luke-warm State above-mentioned. The best manner of bringing them together, for raising the *Fermentation* quick and strong, seems to be this. When the *Ferment* is solid, it should be broke into small pieces, and gently thinned, with the hand, or otherwise, in a little of the luke-warm Liquor. But a compleat uniform Solution should not be here endeavour'd; because this would, in some measure, weaken the Power of the Ferment, or destroy its future Efficacy. The whole intended Quantity, therefore, being thus loosely mix'd with a moderate parcel of the Liquor, and kept near the Fire, or elsewhere, in a tepid State, free from the too rude

Com-

* The nature and effects of this kind of process have been already touched upon, pag. 65, & 70.

Commerce of the external Air; more of the insensibly warm Liquor ought, at proper intervals, to be added, till at length, the whole Quantity is well set at work together. And thus, by dividing the Business into parts, it may be much more speedily and effectually done, than by attempting it all at once: in which case, 'tis very apt to miscarry, and require a Reparation in the Method already described.

Particular Additions, besides Ferments, required, to give vinosity, flavour, and an increase of spirit.

19. When thus the whole is set at work, secured in a proper degree of warmth, and kept from a too free intercourse with the external Air; it becomes, as it were, the sole Business of Nature to finish the Process, and render the Liquor fit for the Still; and thus the general end of the *Fermentation* would be answer'd. But during the whole course of the Operation, there are several other things that may be added, with some particular View; as either to improve the Vinosity, increase the Quantity of the Spirit, or give a particular Flavour. And such Additions may require some particular Alterations in the general Method above set down.

Viz. Salts and Acids, to increase Vinosity.

20. These *Additions* may be included under the four Heads of *Salts, Acids, Aromatics* and *Oils*. The use of *Salts* for this purpose has been already touched upon*; but when they are omitted in the previous Preparation, they may be commodiously added now. Thus a little finely powdered *Tartar, Nitre*, or common *Salt*, might be thrown into the fermenting Liquor, at the beginning of the Operation: or in their stead a little of the *vegetable*, or *fine mineral Acids* may be dropt in, at different times, where they are found necessary; as particularly in the case of *Treacle, Honey*, and other sweet and rich *vegetable Juices*; which either want a natural Acid, have

* See pag. 61, 64.

have been robbed of it, or hold it but in a small proportion. To this end may be used *Juice of Lemmons, Oranges, &c. Spt. Sal. Glaub. Ol. Sulphur. per Campan. &c.* But the most effectual thing for the purpose is a *particular aqueous Solution of Tartar*; a *Succedaneum* for which, may be *Tamarinds*, or the *Robs of some very acid Fruits*; or better still, the *Media Substantia Vini*. On which Foundation stands that ingenious Practice of constantly using a suitable Proportion of the Still-bottoms, or remaining *Wash*, in the subsequent Brewing. These Additions are manifestly design'd to give a vinous Acidity, or improve that naturally afforded by the Subject; without any Expectation of considerably increasing the quantity of the Spirit: which is the more immediate Use and Design of *Aromatics and Oils*; at the same time that they give, alter or improve a Flavour.

21. All the pungent *Aromatics* have a surprising Property of increasing the quantity of Spirit; but their use requires a *close or compress'd Fermentation*; and if the Quantity intended be large, that the Addition be not made all at once, lest the Oiliness of the Ingredients should hinder the Operation. But if Flavour be the only thing required from them, their Addition should be delay'd till towards the end of the Fermentation. After the same manner a very considerable quantity of any *essential vegetable Oil* may, by the proper *Encheiresis*, be converted into a surprizingly large Quantity of inflammable Spirit: but great care must here again be had not to drop it in too fast, or too much at a time; which might easily damp the Fermentation: and is one of the known ways of checking, or totally stopping this Operation at any point of time required. The best Method of introducing the Oil, so as to avoid all Inconvenience, is to bring it into an *Elæosaccharum*;

And Aromatics and Oils, to increase the quantity of spirit, and give a flavour.

rum; which will readily enter the Body of the Liquor, and directly ferment along with it. In the like prudent manner of proceeding, a large proportion of Brandies, or highly rectified Spirit of Wine, may be introduced into any fermenting Liquor: but the full Prosecution of this Subject, with the Uses and Advantages thereof, do not directly belong to this place. Enough is already said to shew, that an advantageous Method may hence be form'd for increasing the quantity of the Spirit; and at the same time, improving its quality.

22. In all these, and the like Cases, great regard must be had to the *containing Vessel*; the *Exclusion of the Air*, and the *Degree of the external Heat or Cold*. The same ought likewise to be understood, in a degree, with regard to the general Method of working, above delivered.

Cautions required, with regard to the fermenting Vessel.

With regard to the *containing Vessel*; its Purity, and the Provision for its occasional Closeness, are principally to be considered. In cleansing it, no Soap, or other unctuous Body should be used, for fear of checking the Fermentation: all strong alkaline Lixiviums should, for the same reason, be avoided; the Lime-water, or a turbid Solution of Quick-lime, is without any ill effect employ'd for this purpose; particularly to mortify or abolish a prevailing acetous Acid, which is apt to generate in the Vessels, if the warm Air has free access to them: and thus tends to pervert the order of Fermentation; and instead of a *Wine*, or genuine *Wash*, produce a *Vinegar*. Special care must also be had, that no corrupt or putrefied Yeast, or cadaverous Remains of former fermented Matters hang about the Vessels, which might thus infect whatever should be afterwards put into them; and cannot, when of long standing, be perfectly cured and sweetned without the

utmost

utmost difficulty, or some particular, and hitherto but little known, *Encheiresis*.

23. The *occasional Closeness of the Vessels* may be provided for, by well-adapted *Covers*, in the large way of Business; and by the use of *Valves* in the smaller, where common light Casks will serve the purpose: whilst the *Valve* occasionally gives the necessary Vent to preserve the Vessel; which otherwise remains perfectly close and impervious to the Air, but at discretion.

24. 'Tis a prejudicial Mistake in the Business ^{The exclusion of the Air.} of *Fermentation*, to suppose the free Concourse or Admission of the external Air, of absolute necessity to the Operation. The express contrary is the Truth, and a great Advantage will be found in practising upon this Supposition. A constant Influx of the open Air, if it does not carry off some part of the Spirit already generated, yet certainly catches up and dissipates the fine, subtil, or oleaginous, and saline particles, whereof the Spirit is made; and thus considerably lessens the Yield. This Inconvenience is avoided in the way of *close Fermentation*; whereby all Air, but that included in the Vessel, is kept out. The *Secret*, or true *Encheiresis* is to leave a moderate Space for this Air, at the top of the Vessel, unpossess'd by the Liquor; when the Liquor is once fairly at work, to bung it down close, and thus suffer it to finish the Fermentation, without opening or giving any more vent than is afforded by the Valve: which however is not of absolute necessity, when the empty Space, or rather the Space possessed by the natural Air, is about one tenth of the Gage; the *artificial Air* generated in the Operation, being in this case seldom sufficient to force a strong Valve, or at most not to endanger the Cask. This method is practicable to good advantage in the

the small way of business; but requires such a length of time as cannot well recommend it to the large Dealers, who are in a manner forced to admit the free Air, and thus sustain a considerable loss in their Spirit, to finish the Fermentation with that expedition they require. It might otherwise be said that the silent, slow and almost imperceptible vinous *Fermentation*, is universally the most perfect and advantageous.

*Preserving
the Liquor
and Vessel
from too
great cold or
heat.*

25. During the whole course of this operation, the vessel should be kept from all external *cold*, or considerable *heat*, in an equable, uniform, and moderate temperature, that is not remarkably cognizable by the Senses. In the winter, a Stove-room, such as are frequent in *Germany*, wou'd be very convenient for this purpose; the vessel being placed at a proper distance from the Stove: but at other Seasons no particular apparatus is ordinarily necessary, with us in *England*, if the place allotted for the business be but well defended from the Summer's heat, and the ill effects of the cold, bleak or Northern winds.

*The Liquor
to grow fine
by standing.*

26. The operation thus performed *in occluso*, is known to be perfectly ended when the hissing or small bubbling noise can no longer be heard, upon application of the Ear to the vessel; as well as by the clearness of the Liquor to the eye, and its pungent vinous sharpness upon the tongue.

27. And that it may fully obtain these properties, and be well fitted to yield a pure and perfectly vinous Spirit by Distillation, it should be suffered to stand at rest in a somewhat cooler place, if practicable, than where it stood to ferment; till it has thoroughly deposited and cleansed it self of the gross Lee and become perfectly transparent, vinous and fragrant: in which state

State it may be rack'd or drawn off from its bottom, and directly committed to the Still *.

S E C T. III.

Of SIMPLE or SEPARATORY
DISTILLATION.

SIMPLE Distillation is the method of ^{Simple Dis-}separating and collecting the ^{tillation in} inflammable ^{general.} Spirit, clear of all the other parts of fermented Liquors, by means of Fire and the Alembic.

This Operation includes not only what in the language of Distillers is called *working from Wash*, and the *producing of Low-Wines, or Spirits of the first extraction*; but also *simple Rectification*, or the production of *simple proof-Spirit*, and *simple Alcohol*.

The common ways of charging, working and managing a Still, regulating the fire, &c. are here suppos'd to be understood: but in order to improve this operation, and bring it to a truth, several observations and methods are required, besides those vulgarly known and considered.

(1.) 'Tis remarkable that the action of Fermentation works such a change in the body of the Tincture or Solution, as to render it separable, by the action of the fire, into parcels of matter that are specifically different; and of a nature entirely foreign to what, by the same means, the Liquor would have afforded before Fermentation. ^{Fundamental observations relating to it.}

(2.)

* The uses of the remaining gross Lee, which is here separated from the clear vinous Liquor, will be considered hereafter.

SIMPLE DISTILLATION.

(2.) The Still being charged, luted and brought to work, with a soft boiling heat, there first comes over a quantity of intensely pungent, aromatic, nidorous Liquor; which if receiv'd into a large proportion of cold water, throws off a copious, *essential*, *acrid* or *Aromatic Oil*; tho' the original Subject were ever so cooling, mild or contrary to a spicy nature.

(3.) This *essential Oil* is, by Experiment, found to be the principal thing that gives the predominant or peculiar Flavour to Spirits; which are hence by their taste and odour, denominated *Malt-Spirit*, *Melass-Spirit*, *Cyder-Spirit*, *Wine-Spirit*, *Arrack*, &c.

(4.) The finest, most subtile, and most efficacious part of this *essential Oil* is what comes first; the succeeding Portions growing gradually more sluggish, viscous, resinous, nauseous and terrestrial.

(5.) The Spirit running in a continued Stream from the nose of the worm, being examined at different intervals, will be found greatly to differ from itself, both in smell and taste; as changing the Nature of its Oil, much oftener than, without trial, could have been expected.

(6.) Besides this *essential Oil*, the Spirit of the first running contains also an *Acid*, more or less in quantity, and more or less pungent, volatile and sensible to the nose, as the Fermentation has been more or less continued; or according to the degree of Acidity acquired in the operation. And this *Acid* also, may along with the aqueous part that rises with it, be in plenty kept back upon a gentle rectification; tho' where the acid is very volatile, some part thereof is ever apt to rise along with the totally inflammable Spirit, so as to give it a vinosity, not unlike a dilute *Spiritus Nitri dulcis*.

(7.)

(7.) It is manifest, both *a priori*, and *a posteriori*, that Brandies are a compound, consisting of at least four different parts; *viz.* totally inflammable Spirit, essential Oil, Acid and Water.

(8.) And as these several parts do not differ greatly in their specific gravity, or degree of volatility; a strong, tumultuary, boiling heat will drive them all over promiscuously together.

(9.) As, at the beginning of the Operation, there usually rises more totally inflammable Spirit than Water; so after some time, the Stream contains more water than inflammable Spirit: and this gives the foundation for what they call *Low-wines*, *Proof-Spirit* and *Faints*: *Low-wines* being the whole quantity of Spirit, weak and small mix'd together; *Proof-Spirit*, a mixture of about equal parts of totally inflammable Spirit and Water; but *Faints* all that runs after the Proof is fallen off, where the proportion of water is much greater than of the totally inflammable Spirit*.

(10.) These *Low-wines* are commonly redistill'd, to make what they call *Proof-Spirit*, by leaving out their superfluous Phlegm: And in the same manner may the *Faints* also be served; by which means they are suppos'd reducible to a certain Standard, or stated merchantable degree of Strength, called *Proof*.

(11.) When once the Stream falls off from *Proof*, the Liquor contains a grosser essential Oil, which tho' not so communicative as the first, never fails to impregnate the whole with its flavour.

(12.) Hence all common *Spirits* or *Brandies* are really dilute *Quintessences*, as the Chemists call them; that is, a mixture of the ardent

G 2

Spirit

* For the methods of taking Proof, or distinguishing by certain marks or signs, the Strength of Brandies and Spirits, See hereafter pag. 89—91.

Spirit and essential Oil of the Concrete ; only here let down to *proof* with water, and impregnated with a small proportion of a volatile Acid.

(13.) When the *Proof* falls off, the liquor grows milky ; that is the oil, which before remain'd dissolv'd by the strong Spirit, is set loose from it by an over-proportion of water ; and may now be commodiously separated by the Chemical Glass fitted for that purpose.

(14.) 'Tis customary to continue the Distillation so long as the Liquor that runs will take fire at the flame of a Candle, applied to the vapour of a small quantity thrown upon the hot Still-head : and indeed there is a certain point of time, when the *Spirit* obtain'd will not pay the fire, and labour ; viz. when not above a twelfth or fourteenth part of totally inflammable Spirit comes over in the water.

(15.) With other views however, as particularly the obtaining a more fix'd vegetable acid, and a grosser *essential oil*, the operation might be continued, till the danger of an Empyreuma comes on.

(16.) The matter remaining in the Still, after the operation is ended, has several uses ; and might in particular be made to afford Mr. Boyle's acid *Spirit of wine*.

(17.) When by repeated Distillation, without addition, any Spirit is entirely freed of its aqueous parts ; 'tis then call'd totally inflammable Spirit, *Alcohol*, or perfect Spirit of wine.

Upon these general observations may be form'd some new practical methods for the improvement or perfection of Distillation.

(1.) And first, as the fermented Liquor affords different parcels of matter, of different specific gravities or degrees of volatility ; when a pure Separation of the lightest part is intended, the Fire should never rise to a boiling heat, which
jumbles

Jumbles and confounds all the parts together, rather than separates them.

In the Chemical way this Rule may be practised to advantage ; but great difficulties will attend the observance of it in the common business of Distillation.

To render it more commodiously practicable, these two methods are proposed ; viz. (1.) Either to increase the height of the Still above the Liquor ; or (2.) To work in *Balneo Mariæ*.

(1.) By running the Still-head to the height of two or three yards above the Liquor, it has been expected that a boiling heat would carry up the pure inflammable Spirit, without any great mixture of phlegm, and yet continue to run a full Stream. But this does not perfectly answer upon Experience ; tho' the thing is still improveable, and has been attempted by the addition of a tall Serpentine pipe, for the Spirit to creep thro' and deposite the phlegm as it ascends. And thus indeed the Spirit may in a good measure be dephlegm'd : But the great objection against this method, is, that it requires a boiling heat ; which in the case of simple separatory Distillation should never be used : because it throws up so much oil, as to foul at least the breast and head of the Still and bottom of the pipe ; whence it infects the subsequent Spirit that washes them.

(2.) The other way by the *Balneum Mariæ* is preferable on many accounts ; so that by a proper regulation, we might hope for a pure simple Spirit almost at the first extraction. Such an expectation will not appear unreasonable to one who has seen what Spirit is obtainable even in the common method of the *Balneum Mariæ*, (where the water of the Bath is made to boil with the utmost violence,) and compared it with another parcel of Spirit, prepared from the same fermented Liquor in the common way of the hot Still. Indeed the

difficulties of working from Wash in this way of the *Balneum Mariæ* are very considerable; especially if cheapness and dispatch be the principal thing in view. For at once to work both quick and perfect, seems hitherto impracticable in the business of Distillation. The whole Affair has a great dependance upon a suitable *Engine and Apparatus*. And perhaps a large or long rectangular *Boiler* might commodiously be turned into the *Balneum* we speak of; and fitted with a number of low Alembics, that should all work, day and night, with a little fire and less attendance. The Contrivance in general is obvious; but to avoid encumbrance and loss, is the principal difficulty. A large number of vessels or alembics is absolutely necessary; but no Worms and Refrigeratories are required. And by an easy Apparatus the whole number of the small Vessels may be charged with nearly as much ease as a large one. When the operation proceeds so slow as not to quit the cost, all the bottoms may be emptied into a common Still, and work'd in the usual way, for a coarser commodity, that may afterwards be rectified at pleasure. The heat of the *Balneum* shou'd only be tepid, or at most but scalding.

By this means a surprizingly cool, and almost insipid Spirit has been obtained, at the very first extraction; tho' mix'd with a considerable proportion of Phlegm; so that it needed no manner of rectification to fit it even for the finer uses. The method, therefore, at least is curious, and in some cases useful, tho' it should never be brought into a general practice. And indeed a thing of this nature deserves to be kept in curious hands; as by a due application it may furnish productions fit for the Closets of Princes.

In the common Method of *Simple Distillation* all proper Means shou'd be used to prevent the grosser *essential Oil* from getting into the Spirit.

These

These Means have regard, (1.) To the preparation of the fermented Liquor: (2.) The regulation of the fire: (3.) The use of Percolation: and (4.) To the keeping out the Faints.

(1.) For the manner of preparing the fermented Liquor, and clearing it of its gross oleaginous fæces, before 'tis committed to the Still, we have already spoke to it above: And have only farther to add, that the liquor, thus fined, should not possess above two thirds of the Still; that the grosser oleaginous matter may the better be kept down; and the whole have free scope to work, rise and purge itself in the operation: which it never can do, if it wants room. (2.) As in this Distillation a *boiling heat* is necessary, care shou'd be had that the liquor only boil gently and uniformly; without raising the fire by starts; which never fails to throw over the coarse Oil in plenty, and foul the Spirit: so that if possible the operation shou'd be begun and ended with the same uniform and invariable degree of heat.

(3.) The grosser Oil may in some degree be kept from mixing among the Spirit, by stretching a piece of very thick woolly Flannel over the mouth of the Still; or by suffering the Stream to pass thro' such a Flannel, several times doubled and placed at the nose of the worm: and 'tis surprizing what a quantity of gross, offensive, fetid, unctuous matter may thus be collected; especially in the Distillation of Malt Spirits.

(4.) The *Faints* shou'd never be suffered to run among the *finer Spirit*, on account of the large quantity of this *gross oil*, or greasy matter they contain; especially if the fire be increased, as it usually is to bring them over: Tho' some, who value *proof* more than purity, will usually have a dose thereof to give their goods a face. Which

prevailing fondness for a strong hanging Proof, however absurd in itself, is one principal reason why the common malt-Spirits are no cleaner.

This Caution of keeping out the *Faints* should likewise extend to the keeping out a little of the first running, which too, in this operation, is a kind of *Faints*; as containing largely of the oil of the concrete; tho' much more subtile than that in the proper *Faints*. A farther regard must also be had to the *Still-head*, and *Worm thro'* which the *Faints* have once passed; as these all along deposite such a copious, infecting oil, as gives a predominant flavour to an almost incredible quantity of pure Spirit. Nor is this Oil easily dislodged from the Pores of the spongy Metal, by running hot water through the worm; but either requires a quantity of boiling Lixivium; or else some highly rectified Spirit to stand in the worm all night, to imbibe, dissolve and carry it away. And if these cautions are carefully observed, a much better and purer Spirit may be obtained after the common method, than those who have not tried it would expect.

When now the *Faints* have run off, and it becomes unprofitable to continue the operation longer, the original mass of *fermented Liquor* is separated into *Still-bottoms* and *Low-wines*, or *Spirit of the first Extraction*. The several parcels of spirituous Liquor come over, are then usually mixed together, and thrown into another Still, to be rectified into what they call a saleable *Commodity*, or *proof Goods*.

This operation is a *Second Species of simple Distillation*, which without any addition tends to cleanse the whole body of the *Spirit* from the *grosser Oil* of the *Faints*; provided the work be carried on in a mild and gentle manner: Otherwise it serves but to keep back the superfluous
Phlegm

Phlegm, that sunk the Spirit much below proof, rather than to improve its quality.

Here again, therefore, the operation should be slowly performed with an uniform, well-regulated Fire, or rather in *Balneo Mariæ*, with a due observance of the preceding Cautions to keep out of the Spirit the grosser Oil of the Faints; and instead of these, to *make up*, as they call it, to Proof, with pure distill'd or simple water. But here a considerable difficulty will occur as to fixing the proof, when the *gross* Oil that gives it, is left out: A difficulty no less perplexing to the Distillers, than to his Majesty's Officers of *Customs* and *Excise*. This point being so material, and so little understood, as to the true grounds and reasons of it, deserves to be fully explained.

Proof may be distinguished into *perfect*, *more than perfect*, and *less than perfect*.

By *perfect Proof* is vulgarly understood a certain crown of *Bubbles*, of a certain size, arising as a head, upon a small parcel of well-qualified Spirits, shook in a slender vial; which bubbles, upon permitting the vial to rest, remain a while, then go off in a certain full and strong manner; suppos'd to be known only by those who thro' use and custom have obtained the faculty of judging the Strength of the Spirits by this means.

Proof more than perfect is that wherein the Bubbles are larger, and go off more suddenly than in the *perfect*; that is, according as the Spirit is higher, or approaches nearer to what is commonly called *Spirit of Wine*.

Proof less than perfect is that wherein the Bubbles are smaller, and go off quicker and fainter than in perfect proof; the Spirit in this case being mixed with above its own quantity of Phlegm.

The *Commercial Notion* of *Perfect Proof* runs so high, that the people in trade, both at home and abroad,

The Foundation, Nature, Doctrine, and Uses of Proof explain'd.

abroad, seem to place the chief excellence of Spirits and Brandies in it; and buy and sell upon this weak and ridiculous Foundation. 'Tis much that people attached to profit, and watchful against impositions, have not reflected that *Arrack* is *proof*, though it contain no more than one fourth of totally inflammable Spirit; that wines have their proof, tho' they hold but about a twelfth; and that many aqueous liquors, especially those wherein saponaceous bodies have been dissolved, are *proof*. Nay, what is more, the *highest rectified Spirit of wine* will, by the addition of a very small proportion of several different kinds of tasteless, or grateful saponaceous bodies, be made to appear perfectly *proof*; and even deceive some more rational ways of trial, so as to pass current for Brandy.

This Hint duly prosecuted will unfold the whole mystery, and shew the fallacy of what is now generally esteemed and used as a most authentic evidence of the strength or goodness of Spirits.

Proof, or the Crown of Bubbles in Spirits, is no more than a particular temporary kind of spume or froth, generated by the oil, dissolved in the totally inflammable Spirit, and thence rendered miscible with a certain quantity of water: So that this Spume or Crown of Bubbles is really owing to the tenacity of the Spirit, in this case occasioned by the Oil. And accordingly when this Oil is left out, or its viscosity lessened, by repeated distillations, or by some common ways of rectification, the proof is advanced nearer to the Proof more than perfect; and by due prosecution, a Spirit consisting of half Alcohol and half Water, will be made to give no signs of perfect proof at all: as on the other hand, the most subtilized and highly rectified Spirit of Wine will, by a slight and inconsiderable

derable *addition*, tho' sufficient to increase its tenacity, be made to exhibit the fair and full Phænomenon of perfect *proof*. Nay, so very precarious a thing is *perfect proof* in a *Spirit*, that the smallest addition of its own Oil, or other unctuous body, above its own dose, shall instantly destroy it, and make the Spirit which is really of full strength, appear as if it were largely debased with water. Hence it is evident, how easily those may be deceived who rely wholly upon *proof*, as they call it, in the business of Spirits*. And indeed this kind of proof, tho' universally received, is the most uncertain and fallacious of all those in practice for ascertaining the strength and goodness of Brandies; being in reality, and without unfair practice, no other than a certain Sign of a particular degree of foulness, or a *certain quantity of gross essential Oil* contained in them†.

Instead therefore of making Spirits up to this fulsome and uncertain *Proof*, we would recommend that of bringing them into the form of totally *inflammable Spirit*; whose purity is much greater; whose strength may be readily found to exactness; whose bulk, carriage, stowage, and encumbrance wou'd be only a half in comparison of Brandy; and might at all times, as occasion called for it, be extemporaneously mixed into a great variety of useful Liquors, of any precise degree of strength. This *operation* in the common way proves indeed so tedious, expensive, and after all so unsatisfactory and short of perfection, that it is not to be expected *Distillers*, till they are shewn a better manner of working, should

* For the best ways of judging the qualities or goodness of different Spirits, see pag. 92, &c.

† See this affair of proof, farther considered under Brandies, hereafter.

should come into the proposal: but if they will try the large rectangular *Boiler* above recommended for a *Balneum Mariæ*, with a proper set of *tall conical Vessels*; they may not perhaps be displeased with the Contrivance. For they here need no addition of Salts, but may work expeditiously and more effectually without them; as thus preserving the fine essential vinosity of the Spirit, which, in the common way, they constantly lose. At least this method might be practised for the finer uses of the *Apothecary*, *Compounder*, &c. who require a pure vinous Spirit, not already dosed and impregnated with a *fulsome oil*.

The *proof* by which this Spirit is bought, need, for common use, be no exacter than to burn perfectly dry in a Spoon.

Or if our new method should never obtain, but all Spirits must needs be bought or sold by the bubble *proof*; some other ways of Trial may be recommended, to confirm that which of itself is so very fallacious and uncertain.

*Ways of
judging the
strength of
Spirits.*

The surest methods of determining the Strength of Spirits, are principally three; viz. (1.) The Hygrometer, Water-poise or Balance; (2.) Distillation; and (3.) Deflagration.

The specific gravity of totally inflammable Spirit, is so much less than that of phlegm or common water, as to be sensible upon the balance; whence an exact Hygrometer, well graduated and furnished with a proper scale and weights, may be of use to assign the proportions in which Alcohol and Water are mixed. Tho' perhaps a more ready way for this purpose is that advanced by M. *Homberg*† for determining the different gravities of different fluids, by means of a bottle with

† Vid. Memoir. de l'Academ. An. 1718.

with a very long and slender neck; which being filled to a certain height with any mixture of Spirit, is weigh'd against the same Bottle filled with pure water.

Distillation, however, is a method less subject to error; but as it requires a good deal of time and trouble to dephlegm any Spirit to perfection, this cannot be of ready use, tho' it might determine the Point to the utmost exactness. The best method therefore, when all things are considered, seems to be that of *Deflagration*, which M. *Geoffroy* has been at some pains to adjust and improve. The common experiment is to take a certain measured quantity of the Spirit proposed to be assay'd; then to heat it and set it on fire; whence it will continue burning so long as any inflammable part is left in the mixture: and now if the remaining phlegm measures half as much as the original Spirit; then is the Spirit merchantable, or what ought to be understood by proof Spirit. But so much as the phlegm falls short or exceeds of that measure, so much does the Spirit either approach to Alcohol, or recede from the proof of saleable Brandy.

To make this experiment with the greater exactness, M. *Geoffroy* advises a cylindrical vessel two inches high, and as much in diameter, consisting of thin plate-silver; as being less subject to rust than Copper. This vessel he fits with a little rectangular Gage, exactly graduated into Lines, half Lines, &c. Then the vessel being set level, upon the bottom of the Copper-case made to contain it; a parcel of Brandy to be examin'd is pour'd to the height of 16 Lines. This height is exactly hit by pouring in more than enough at first, and with a small tube taking out what is superfluous. Then the vessel being heated a little,
so

so as just to make the Liquor fume, 'tis set on fire, and suffer'd to burn out of it self. At the instant the flame expires, the Gage is plunged perpendicularly into the vessel, and the Lines and Quarters exactly noted, which the liquor wants of its former height. And this difference gives the precise quantity of Alcohol originally contain'd in the Liquor. Thus if eight Lines of phlegm are found remaining, the Brandy was good, proof and merchantable; but if there remain no more than four lines of the phlegm, the spirit was double, or of a middle strength betwixt common Brandy and Alcohol; and so of other Proportions.

Thus much of simple Distillation, in general; we come next, by way of Example, to consider it in the particular Production of Malt-spirit.

Simple Distillation in particular,

OF SIMPLE MALT-SPIRIT.

Malt-wash, being of a mucilaginous or somewhat glutinous nature, requires a particular Encheiresis to prevent its scorching, and to make it work kindly in the Still. If it should happen to be burnt in the operation; this would give the Spirit a most disagreeable flavour, or empyreuma, that cannot be got off again, without the utmost difficulty, or some very particular treatment. To prevent any such ill effect, (1.) The wash should be made dilute; (2.) The fire be well regulated; and, (3.) The Liquor kept in a constant agitation.

The manner of making the wash dilute, has been already touched upon; so likewise has the regulation of the Fire: And as for the constant agitation of the wash, this may be effected three different ways; viz. (1.) By stirring it

it with a Paddle or Oar, till the Liquor begins to boil, then immediately luting on the head. This is the common way. (2.) By putting some move-able solid bodies into the Still. And, (3.) By placing some proper matter at the bottom and sides, or where the Fire acts the strongest.

(1.) The usual method of stirring with the Paddle, is very defective; as being of no use after the Still is once brought to work; whereas it often burns in the working. This method is greatly improveable by an addition to the Structure of the Still; whence the agitation may be commodiously continued during the whole operation: and this tho' the wash were made very thick; or Wine-Lees themselves were to be distilled. The method is this. Solder a short Iron or Copper-Tube in the Center of the Still-head; and below, in the same head, place a cross-bar, with a hole in the middle, corresponding to that a-top; thro' both which, is to run an iron-pipe, deep down into the still; and thro' this an iron rod: to the bottom whereof wooden sweeps are to be fastened; so that this rod being work'd a-top, backwards and forwards, with a Winch, they may continually rake and clear the bottom plate and adjacent sides of the Still: The interstices of the Tubes being at the same time well cram'd with tow a-top, to prevent any evaporation thereat.

(2.) The same effect may in good measure be secured by a less laborious way; viz. by placing a parcel of cylindrical Sticks lengthwise, so as to cover the whole bottom of the Still; or else by throwing in a parcel of loose Faggot-sticks at a venture: for thus the action of the fire below moving the Liquor, at the same time gives motion

tion to the Sticks, and makes them continually act like a parcel of Stirrers upon the bottom and sides of the Still; so as to prevent the Liquor from scorching.

(3.) But a better method still, is upon a parcel of large cylindrical Sticks to lay loose hay, to a considerable thickness; securing it from rising by two ash-poles laid a cross, and pressing hard against the sides of the Still; which might, if necessary, be furnished with buttons or loops, to secure the poles from starting. But care must here be had, not to press the hay against the sides, for that would presently make it scorch; which being otherwise defended by the Sticks, 'tis not apt to do.

These are simple, but effectual contrivances; which in point of elegance are easily improveable at pleasure.

There is a farther inconvenience attending the distillation of *malt-spirit*, when all the bottoms or gross mealy feculent Substance is put into the Still, along with the wash: which thus coming to thicken a little, like Starch in the boiling, and losing the thinner Liquor, wherewith it was diluted, as the Still works off; the mealy mass at length grows so viscous, as sometimes to scorch towards the end of the operation. To prevent this ill effect, 'tis very proper to have a Pipe, with a stop-cock, leading from the upper part of the *Worm-tub* into the *Still*; so that upon a half or a quarter turn, it may continually supply a little stream of hot water, in the same proportion as the Spirit comes off, by which means the operation will be no ways check'd or hinder'd.

But in *Holland*, where they work their wash thick, with all the malt and meal along with it, they commonly use no art at all to prevent burning; only charge whilst the still is hot and moist,

moist, after having been well wash'd and cleansed. And yet they very rarely scorch; unless it be now and then in the winter. When such an accident happens, they are extremely solicitous to scrape, scrub and wash off the least remains of the burnt parts; by which means they effectually avoid the danger there would otherwise be of burning a second time.

But most effectually to prevent any accident of this kind, there is nothing comparable to the way of working by the *Balneum Mariæ*; if the Distillers could have the address to find their account in it.

All *simple Spirits* may be considered in the three ^{or bre} different States of *Low-wines*, *Proof-Spirit*, and ^{States of} *Alcohol*: the intermediate States being of less ^{Spirits} general use; and to be judged of according as they approach to or recede from these. *Low-wines*, at a Medium, contain a sixth part of totally inflammable Spirit; five times as much water as perfect Spirit, necessarily rising in the operation with a boiling heat. *Proof-Goods* contain about a half of the same totally inflammable Spirit; and *Alcohol* entirely consists of it.

Malt-Low-wines, prepared in the common way, are exceeding nauseous, fulsome and disagreeable. They have however a natural vinosity, or pungent acidity, that would render the Spirit agreeable, were it not for the gross Oil of the malt, abounding therein. When this Oil by suitable contrivances, as mentioned above, is kept from running in among the *Low-wines*, they prove considerably sweeter, both to the smell and taste; and less thick and milky to the eye.

When distill'd over gently, in order to their rectification into *Proof-Spirit*, they leave a considerable quantity of this gross fetid oil behind, with the phlegm, in the Still. But if the fire be

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made

made fierce, this oil is again thrown over, mix'd with the Spirit; and being now broke somewhat fine, impregnates it rather in a more nauseous manner than at first. And this is the usual fault committed not only by the *Malt-stiller*, but even the *Rectifyer*; who instead of separating and keeping back the foul parts, according to the design of the operation, really brings them over in greater vigour. Whence it is not unusual, after repeated *Rectifications*, as they call them, both simple and compound, to find the Spirit much more nauseous and disagreeable than it came from the hands of the *Malt-stiller*. The remedy is plainly, either gentle and soft working in the common Engine; or the prudent use of the *Balneum Mariæ*.

Malt Low-wine, when brought into Proof Spirit, appears bright and clear, without the least cloud or milkiness; no more oil being contain'd in the mixture than is perfectly dissolved by the Alcohol, weakned with its own quantity of phlegm. Its taste also is much cleaner for the same reason; viz. because no gross parts of the oil can, in their own form, hang upon the tongue; but now pass readily and slightly over it: which is not the case in Low-wines and Faints; where the Oil remains distinct and undissolved.

When *Proof Malt-Spirit* is distill'd over again, in order for *Alcohol*, if the Fire be raised when the *Faints* begin to come off, a very considerable quantity of Oil will be brought over, and run in the visible form of Oil, from the nose of the worm. Tho' this is not peculiar to *malt-spirit*; but others also, and even *French Brandies* do the same; so that sometimes half an ounce or more of this Oil may be collected from a single *Piece of Brandy*.

Malt-Spirit, more than almost any other; requires to be brought into the form of Alcohol, before

before it can be used internally; especially as it is now commonly made up, with as much fulsome Oil in it as will give it the strongest proof. On which account it is, that in all compound Waters, not excepting those of the Apothecary, an indifferent judge will easily find the predominant flavour of this fulsome Spirit, thro' that of all their Ingredients. For this reason, it ought at least to be rectified in *Balneo Mariae*, to a perfect *Alcohol*, before 'tis used in the finer Compositions.

And when once brought, with a due care and art, to a perfect *Alcohol* indeed, 'tis then preferable to the *French Brandies* for all curious internal uses; as being a much more uniform, hungry, tasteless and impregnable Spirit than those usually are.

This *Alcohol* ought to be kept in close earthen Vases or Jars; not only to prevent its evaporation, but also its colouring it self with the resinous parts of the Oak, which it dissolves powerfully when preserv'd in *Casks*.

The quantity of pure *Alcohol* obtainable from a certain quantity of malt differs according to the goodness of the subject, the manner of the operation, the season of the year, and the skillfulness of the workman: According to which variations, a *Quarter* of malt may afford from eight or nine, to thirteen or fourteen Gallons of *Alcohol*; which should encourage the *Malt-Stiller* to be careful and intelligent in this business. As after each operation in the common way, there is always a Remainder of Faints, which never ought in their foul State to be mix'd among the cleaner Spirit; they should either be converted to other uses, or treated in a particular manner, so as to make a pure *Alcohol*: The uses they are otherwise fit for, being principally external; or when

*The quantity
of Spirit
yielded by
Malt.*

redistill'd to a proper height, burning in Lamps : for which purpose they may have their disagreeable odour corrected by proper Aromatics, or other Ingredients, used in Distillation.

But to make them into pure and perfect *Alcohol*, is a work of greater difficulty; yet practicable, tho' not perhaps to advantage. One way of effecting it, is by slowly rectifying them from water into water; by which operation several times repeated, a pure Alcohol may be obtained from the foulest and most oleaginous Faints. But of this method, and others for the like purpose, more hereafter.

*Uses of the
Still-bottoms.*

The *Oeconomical Use* of the Still-bottoms of the *Malt-wash* is sufficiently understood by the Malt-Stiller; and being so profitable an Article, may, perhaps, render him less solicitous about the improvement of the other Branches of the business.

But these bottoms might have some farther, if not more advantageous uses than feeding of *Animals*. Thus in particular, they might in a chemical way, afford a large proportion of an *acid Spirit*, an *Oil*, a *Fewel*, and a *fixed Salt*; and with some address and good management a *Vinegar* or a *Tartar*. Besides this, one uncommon use thereof has been already touched upon, where the refuse *wash* is observ'd to be very advantageously employ'd, instead of water, in the next brewing: as more readily disposing the Subject to ferment; giving the Spirit a vinosity, and somewhat increasing its quantity. But the proportion for this purpose should not exceed that of a fifth or sixth of the whole Liquor employ'd.

The Liquor left behind in the Still, upon rectifying the Low-wines, is little more than mere phlegm or water, impregnated with a few acid
and

and some oily parts ; not worth separating, unless for curiosity. And the same is to be understood of the Liquor left behind upon distilling *Proof Spirit* into *Alcohol*.

As a Species of *simple or separatory Distillation*, we ought not to omit the distillation of *Wine-Lees* ; which indeed has a near affinity with the distillation of *Malt-wash* ; especially when all the mealy substance is left in it. The principal difference lies here ; that as in the simple Distillation of *Malt Spirit*, the design is, as much as possible to keep back the *essential Oil*, because of the foulness and ill flavour it communicates ; the essential Oil of the *Wine-Lees* is studiously to be brought over, and carefully preserved, for some considerable uses.

The Method of Distilling WINE-LEES.

By Distilling *Wine-Lees* is understood not only *Wine-Lees*, the method of obtaining their *Spirit* or *Brandy*, bevo distilled. but also their *essential Oil*.

The treating of this matter will unfold a very profitable business, and render it practicable with great facility.

Glauber has a little Treatise upon the same Subject, wherein, without considering the most advantageous production of all, he makes the work so gainful, that it has generally passed for one of his Flights, rather than a solid business.

The Method of distilling a *Liquid Lee* for its Spirit, is commonly known and practised ; but the thing here proposed, is to distil a *solid pressed Lee*, so as, at first or last, to procure and separate all its valuable parts. The *solid Lee* meant, is that usually sold to the *Hatters* in *England* ; and is the same thing, that in *France*, and other Wine Countries,

Countries, the *Vinegar-makers* dispose of in Cakes, after they have pressed out the Wine; and which is afterwards burnt into what they call *Cendre Gravelle*; or a Species of *Pist-Ash*.

This *Lee* for the purposes intended should be the *French*; and either fresh pressed or well secured by close packing in tight Casks; with some proper contrivance of dry sand, or the like, to keep its external surface from the contact of the Air; which is very apt to corrupt or putrefy it, and thus absolutely disqualify it for the ends 'tis here proposed to answer. And the better to secure it, if intended to keep for many months, 'tis proper, in the packing, to sprinkle the Layers with *Brandy*, which will not be lost in the operation.

It has been already observed, that the *essential Oil* of the Concrete is copiously contained in the *Lee*, deposited upon Fermentation; and the present consideration is, how to separate this oil to advantage.

The Method is plainly no more than this. First, steep the *solid Lee* in six or eight times its own weight of water, stirring them now and then very well together; by which means they will unite into an uniform solution, like Clay-water; the grosser, terrestrial and lumpy parts falling to the bottom. With this thinner fluid the Still is to be charged, and worked, exactly in the same manner as *Chemists* do to gain the light, essential oils of Vegetables.

If care be used in the mixing, charging, and regulating the fire; so as to make the Still hot and dewy before the matter is put in, there will be little danger of burning: Tho' this may be more effectually prevented by the methods above delivered for the purpose,

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The time of stopping the Operation, the manner of separating the Oil, rectifying the Spirit, again using the distill'd Water, with other Particulars of the like kind, are here supposed known: but it may be less obvious, that if the *essential Oil* be expected fine, the *Separating-Pot* should be shifted soon; otherwise a gross, resinous, and much less agreeable *Oil* will mix with it, that cannot be separated again, without a more careful Re-distillation.

And this fine, subtle, ethereal *Oil*, of the first running, is the thing here principally intended; ^{Use of the Oil of Wine.} the Use whereof is so extensive, that half an Ounce, or three quarters of it, may serve to determine and denominate a very fine and pure Malt-Spirit to be *French Brandy*; so as to stand the test of the nicest Palate, and other exact ways of Trials; provided the thing be done in an elegant, scientific, and workman-like manner.

To render this Experiment absolutely successful, there are several Cautions required: thus, (1.) The *Lee* must be of the right kind, or of the same nature with the *French Brandy* proposed to be imitated: (2.) The Spirit must be exceedingly pure: (3.) The Dose must be well proportioned: And, (4.) The whole must be artificially united into one single uniform Liquor. Yet these Particulars only regard the Taste; whereas there are several others to be observ'd with regard to Colour, Proof, Tenacity, Softness, &c. so that, in short, the Operation has too much Nicety in it to be hit off by every ordinary Dealer. When this fine Oil is once obtain'd, it shou'd be mix'd into a *Quintessence* with pure *Alcohol*; to prevent its growing in the least distasteful, rancid, or resinous: and thus it may be long preserved in full possession of its fine Flavour and Virtues. A Parcel of such

Quintessence made with the true *Cognac Oil*, is a Present for a Prince.

*Uses of the
Still-Bot-
toms, or
Refuse Lees.*

The *Still-Bottoms*, in this case, are capable of affording many Productions, to great advantage ; particularly *Tartar*, and *Salt of Tartar* ; as also an empyreumatic Oil, and a volatile Salt ; like that of Animals. But the particular Methods of obtaining and applying all these to profit, does not belong to this place. This only need be here observed, that some kinds of *Lees* afford all these Commodities in much greater proportion than others : thus but very little of them is procurable from the Lees of *Canary* or *Mountain Wines* ; and indeed scarce any *Tartar*, or fixed Salt at all : but the white *French Lees*, of those thin Wines that afford ordinary Brandy, yield them all copiously ; insomuch, that sometimes a single Hogshead of dry and close-press'd, white *French Lee*, shall afford three Gallons of Brandy, forty Pounds of clean *Tartar*, a good deal of Emphyreumatic Oil, and volatile Salt ; besides Fewel, and four Pounds of pure *Salt of Tartar*. But every parcel does not yield at this large rate.

S E C T. IV.

Of RECTIFICATION; SIMPLE *and*
COMBINATORY.

RECTIFICATION may be divided into *proper*, and *improper*. *Proper Rectification* ^{*Rectification, proper and improper.*} is the Method of reducing a *Spirit* to its utmost Simplicity, and Purity.

Improper Rectification, is that kind of Distillation, wherein some particular Ingredients are added to the charge; with a design to alter, improve, or abolish the natural flavour of the Spirit that comes over.

This Operation, as vulgarly managed, might otherwise be called *Combinatory Distillation*; because some parts of the Ingredients employ'd, actually come over, and mix themselves along with the Spirit, so intimately as not to be separated again, without great difficulty: whence, instead of abolishing, they only obscure, pervert, alter, or compound the Taste and Odour of the Spirit, said to be *rectified*.

The Foundations of *proper Rectification*, are laid in the preceding Section, where a clean Spirit is directed to be procured from the Wash, and purified from the Low-Wines, and vulgar Proof, up to perfect *Alcohol*; which is nearly a simple and homogeneous Liquor. The principal business here, is to keep the *essential Oil* from entering the Spirit; whereto, when once admitted, it is very apt to cleave, and strongly adhere: and as, by the means above-described, it is much easier to keep them asunder, than to separate them

*Simple or se-
paratory
Rectifica-
tion.*

them again, after they are mixed; their coming together should, by all means, be prevented.

To disjoin them, when once mix'd, or to effect their entire separation, there are some particular Methods; the more practical whereof are, *repeated Distillation, and Percolation.*

These Methods are practicable, either upon Spirits below *Proof*, *Proof*, or *above Proof*; but to most advantage upon Low-Wines, or Spirits, not yet brought to proof: as the Oil to be got out, is not here totally dissolved, and intimately mixed with the Spirit, on account of the over-proportion of the Water; which, diluting the Alcohol, will not suffer it to imbibe that quantity it otherwise would. In this state therefore, there is a good opportunity, by gentle and slow working, to leave a large proportion of Oil behind, in the tall Body, or Alembic, placed in a *Balneum Mariæ*. But if, by this means, the Spirit becomes not sufficiently pure, and simple, it may again be let down with fair Water, to the size of *Low-Wines*, and re-distilled in the same, soft, and equable manner. And thus it may be made of any assign'd degree of purity; especially if the Spirit be suffered, in the working, to fall into several parcels of Spring-water; whence it will have the best opportunity of throwing off its essential Oil: The Operation being repeated so long as any Oiliness, or Milkiness, appears in the Water, or till the last Water employed remains perfectly insipid, and inodorous. And in the same manner may *Proof-Spirit*, and *imperfect Alcohol*, be let down with clean Water, re-distill'd, and at last brought to the state of *perfect Alcohol*. Something towards the separation of this Oil may be likewise effected, by the use of proper Filtres, or Strainers. Thus, *Paper, Parchment, Sand, Stone, Woolly Matters, &c.* might be used for this purpose;

pose; provided they contain nothing that is soluble by the Spirit, or capable of fouling it. And with this view, some have spread a thick folded Paper, or double Parchment, over the mouth of the Vessel, in rectifying Spirit to pure Alcohol. This Operation by *Percolation*, may, at least, be assisting to the former. There are other Methods of reducing Spirits to their utmost Simplicity, tho' the Oil should not be totally got out of them; or even tho' a large quantity were designedly lodged in them. The most simple Method for this purpose, appears to be that by *long Digestion*; which is best practised upon *imperfect Alcohol*: for this being already deprived of a large proportion of its grosser essential Oil; only the finer part will remain to be attenuated by the Operation, and ground to the size of the Particles of pure *Alcohol*; whence the whole will become one simple, and nearly uniform fluid. But this Operation requires a gentle Heat, close Vessels, and a great length of time to compleat it; especially if the quantity of Oil to be transmuted is large. To answer the same end, more expeditiously, it has been propos'd to re-distil the imperfect *Alcohol* a very great number of times successively, till all its Particles are, by the Action, and Motion of the Fire, ground, comminuted, and reduced to the same size. But this also is a tedious and expensive way.

The Inconveniences attending all these Methods of bringing Spirits to their utmost Purity, have occasion'd another to be studiously sought after, that might effect the thing in a different manner: or in the way of *Inversion*, which might, if once perfected, prove a very commodious Operation. By *Inversion* is here meant, the Method of suddenly changing the essential Oil contained in a Spirit, to Spirit itself; or, at once, depriving

any

any particular Spirit of its natural Flavour, and bringing it to a state of Neutrality; whether by any particular Addition, Encheiresis, or Operation. A settled Method of doing this, perhaps remains hitherto undiscover'd; but there are several known Phænomena of the like surprizing nature to countenance the thing. Thus Oil of Cinnamon is inverted, or absolutely deprived of its Nature by Salt of Tartar; and *Alcohol* itself may, by a particular Addition, be inverted, or turned to Water. And an expectation of effecting some extraordinary change upon Spirits, by means of certain saline Bodies, has given rise to the present Methods of *combinatory Rectification*.

*Combinatory
Rectifica-
tion, in its
various
Methods.*

The common Methods of Combinatory Rectification, are very numerous; almost every Distiller pretending to a particular *Nostrum* for this purpose. But as the principal Subject of the Operation is Malt-Spirit, the several ways in use for rectifying it, are reducible to three general ones; viz. That by *fix'd Alkaline Salts*; that by *Alkaline Salts*, along with *Acid Spirits*; and that by *Saline Bodies*, and *Flavouring Additions*.

*By alkaline
Salts.*

The most prevailing Method is that which turns entirely upon the use of *fix'd Alkaline Salts*; as being very cheap, and practicable. But it is surprizing to see with what negligence this obvious, familiar, and easy Operation is usually perform'd by our *Distillers*; who, nevertheless, are allow'd, in the business of Rectification, to exceed those of other Nations. The effect of this Operation, when carefully perform'd, and according to the Rules of Art, is greatly to attenuate and thin the Spirit; keep back a large proportion of its gross, fetid Oil; and so far to alter the part that comes over, as to leave the Spirit scarce knowable for a *Malt-Spirit*. And this end is secured by a steady, prudent management of the Fire; and leaving

leaving out the *Faints*. But instead of this careful slow way of procedure, our Distillers commonly work their Still in its full force; drive over the Oil they should keep back; and even suffer the *fulsome, bitter Oil*, now made into a kind of liquid Soap with the Salt, to run among their Spirit, with the Faints: whence the whole Operation is frustrated; and the Produce render'd much harder to cleanse, than it was before.

This Operation is usually perform'd upon *proof Spirit*, with the addition of eight, ten, twelve, or fourteen pounds of dry *Salt of Tartar, fix'd Nitre, Pot-Ash*, or more commonly, *calcin'd Tartar*, to a Piece. The Tartar, being only roasted to blackness, is often, for this purpose, sold under the absurd name and notion of a *vinous Salt*: whence you shall hear some Dealers praise the *Vinosity* of their Spirit, rectify'd from this Salt; that never fails to give, instead of a pungent, acid Vinosity, a saponaceous, urinous, or lixivious Taste and Smell. And this, indeed, is the great imperfection of the Method by *fix'd Salts*; part whereof actually becoming volatile in the operation, (as may be shewn by particular Experiments) passes over the Helm, and intimately mixes with the Spirit, and that portion of Oil it still contains: which Oil is, by this means, still firmer united to the Spirit; and quits it with the greater difficulty in subsequent Operations. So that, in reality, the Spirit thus rectified, is no other than an alkaline, or *tartarized Spirit*, as the Chemists call it; a thing infinitely different from a true *vinous Spirit*. This Method therefore, tho' it were pursued to its utmost perfection, would, in great measure, become destructive of the end 'tis propos'd to answer; without some farther addition, or alteration.

Hence.

By alkaline
Salts and
Acids.

Hence there appears a kind of necessity for the use of some *Acid*, to mortify the prevailing *Alkali* in the Spirit, so rectified: and this gives occasion to the second *Method by fix'd Alkalies, and Acids*. The Acids, usually employ'd for this purpose, are various; but chiefly of the mineral kind, on account of their cheapness. Thus *Oil of Vitriol, Spirit of Nitre, Oil of Sulphur, &c.* have been tried, with indifferent success; inso-much, that the most celebrated Rectifiers owe their improvements to this Foundation. There is some choice, however, to be made of these Acids; for they have different effects upon the Spirit, and must not only be duly proportion'd, but incorporated, or introduced by suitable *Encheireses*; which, every one is not master of. And indeed, without some skill, and judgment, in the management of these violent Corrosives, no Distiller should be too busy in the use and application thereof. Neither are these strong, *mineral Acids* so well adapted to the work, as the weaker; particularly the *sulphureous Spirit of Vitriol*, which comes over upon rectifying the *Oil of Vitriol*: and to this may be added, the common *Spiritus Nitri dulcis*; and Mr. Boyle's *acid Spirit of Wine*, well rectified. Of kin to this Method, by *fix'd Alkalies*, is that by the use of *Quick-Lime*, which cleanses and dephlegms considerably; but afterwards requires the assistance of *Acids* also, to take off, not only the alkaline disposition, but also the nidorous odour it leaves behind. Less of this particular odour is given by Chalk, Virgin-Earth, calcin'd and well purified animal Bones, &c. which may have their use in rectification; without rendering the Spirit too alkaline for the purposes of the Distiller.

By saline
Bodies and
other Ingre-
dients.

The Method by *saline Bodies, and flavouring Ingredients*, consists either in the use of *fix'd, alkaline*

kaline Salts ; dry'd, or decrepitated *common Salt* ; *calcined Vitriol* ; *Sandiver*, *Alum*, &c. the flavouring Ingredient being applied afterwards, and the whole quantity of Spirit either drawn over again or not, as the Addition requires. But these saline Bodies perform so extremely little, as usually to leave the Spirit impregnated with a disagreeable flavour, that cannot be overpower'd by *Mace*, *Orrice*, *Parsnip*, *Rhodium*, *Artichok*, *Raisin-Stalks*, *Damask-Roses*, *Wine-Lees*, *Rape*, or *Grape-busks*, nor even the Oil of *French Wine* ; or any artificial Mixture of various suitable Ingredients : which if once the Spirit were pure, might give, to tolerable Exactness, the genuine Flavour of some foreign *Brandies*.

The ultimate Perfection aimed at in all these Methods of *Combinatory Rectification*, is at one single Operation, either to depurate *Malt Spirit*, so as to render it tasteless and inodorous, yet vinous ; or else to make it resemble *French Brandy*, *Arrac*, or other very low-flavour'd *vinous Spirits*.

That the thing itself is practicable, may appear from what is deliver'd in the foregoing Pages ; and will be more particularly explain'd hereafter. The Business of flavouring, is attended with no great difficulty ; the principal one is to procure a cheap tasteless Spirit from Malt, fit to receive any particular flavour : and this not in the tedious way of repeated Distillation, long Digestion, or the like ; but in a much shorter, and more practicable manner.

The Method by fix'd *alkaline Salt* may be considerably improv'd, in this View ; by steeping the Spirit, first brought near to the State of
Al-

Alcohol, upon well dry'd *Salt of Tartar*, or other cheaper, but pure, fix'd *Alkali*; by which means it will be almost totally freed of its Oil, without volatilizing much of the Salt; as it does in the way of Distillation. And thus with the proper *Encheiresis*, a weak *Tinctura Salis Tartari* may be easily procured; and mortified with an Acid, suited to the purpose, and then distill'd. And if such an Operation be conducted with the requisite Care and Caution, a very tolerable Spirit may be thus procured, to advantage.

By neutral
Salts.

The Use of *neutral Salts* in Rectification, seems to be but little known. By *neutral Salt* is meant a fix'd alkaline Salt, compleatly saturated with an acid one. Such a Salt has indeed been expected from the *Caput mortuum*, or white saline Cake remaining upon the Distillation of the *Spiritus Nitri fortis cum Oleo Vitrioli*; but it proves too hard, chalky, stony, and insoluble, to be of any great significance for this purpose. A better effect may be expected from *soluble Tartar*, carefully prepared, well dry'd, and properly used; tho' 'tis apt to render the *Spirit* a little saponaceous. Some compound neutral Salts, however, have been made upon this Foundation, that would cleanse or rectify common Malt-Spirit, from Proof, at a single Operation, much better than other more laborious and expensive Methods. Nor is a prudent use of fine, dry Sugar, to be despised for this purpose; as it readily unites with essential Oil, detains and fixes it, without imparting any urinous, or other nauseous Flavour to the Spirit that is rectified upon it. Another Hint, to this purpose, is afforded us by the ingenious Method of Dr. Cox, for taking all the Oil out of the volatile Salts;
by

by first bringing them to a neutral State with Spirit of Salt ; and then subliming them with Salt of Tartar : which does the Business to perfection. In the case of Spirits, the Acid may be varied ; and Virgin-Earth, Chalk, calcin'd Flints, or the like Absorbents, used instead of Salt of Tartar. But this is recommended to farther Experience.

That the Business of *Rectification*, may in all Cases proceed to the greatest Exactness, a due regard must be had to it, even from the first Fermentation, or original Production of the Spirit ; and continued through all the Stages of *Low-Wines*, *Proof-Spirit*, and *Alcohol* : and if the Rules hitherto laid down for that purpose, were but carefully observed, so far only as they might, without any great additional Trouble or Charge, we should not hear those frequent Complaints we now do, for want of a clean *Malt-Spirit*, fit for many of the more curious Uses.

And the like careful Method of Proceedure we wou'd also recommend in the cleansing or rectifying of other ordinary Spirits. For 'tis not only Malt-Spirit that requires Rectification : all the others require it in their turn, for some particular, though not for ordinary Uses. And 'tis remarkable, that no one Method of combinatory *Rectification* is found to serve universally for all Spirits ; nor hardly for any two. But the simple way of rectifying, by repeated Distillation, is universal : And may as well be applied to Malt-Spirit as Melasses, Cyder-Spirit, Wine-Spirit, Rum, *French-Brandy*, and Arrac : All which are then known to be perfectly rectified, when they not only prove totally inflammable, in a little Vessel floating upon cold Water ; but when poured into the purest Spring

Water, they leave not the least trace of oiliness, or unctuousity; which, view'd in a certain light, exhibits the colours of the Rainbow.

S E C T. V.

The Natural and Experimental
HISTORY of SPIRITS, Domestic and Foreign.

BY the *History of Spirits*, is here proposed a short account of their Origin, State, and Improvement; with the ways of imitating, adulterating, and judging thereof.

HISTORY OF MALT-SPIRITS.

Malt-Spirit. The *History of Malt Spirit* has already been traced out occasionally; but particularly as to its *Origin*. The *State*, wherein we commonly find it, is either *unrectified*, or *rectified*, and in both cases *proof*; or else brought to an *imperfect Alcohol*. In the first case, 'tis just as the *Malt-Still* leaves it; in the second, as improved by the *Rectifier*; and in the third, drawn high; or brought to the state of what they call *Spirit of Wine*.

It was formerly observed, that the *Malt-Still* gives his Spirit a single Rectification *per se*, in order to purify it a little, and make it up *proof*; but in this state, 'tis not reckon'd fit for internal uses; and so serves only for Spirit of Wine, or Lamp-Spirit; or to be distill'd with *Juniper Berries*, or other Ingredients, into *Geneva*, or other Compound Waters for the vulgar. And

this

this is all the Rectification the *Malt-Spirit* made in *Holland* usually undergoes: the Method there, being barely to distil their Low-Wines to full *Proof-Spirit*; and then directly make it into *Geneva*, or send it to *Germany*, *Guinea*, the *East-Country*, &c. For the *Dutch* have little notion of what we, in *England*, call Rectification; and making of double Spirit. Hence they usually leave their common Spirit so foul, and coarse, as renders even the *Geneva* made with it, very disagreeable. This foul flavour also is greatly heighten'd by their immoderate use of *Rye Meal*, in the production of their Spirit; which, upon that account alone, would be highly nauseous.

In its *unrectified state*, *Malt-Spirit* also is self-*Unrectified*.
 dom found to want the common *Bubble-Proof*; this being requisite to render it merchantable, viz. that it have a good, moderate dose of the gross Oil of the Malt, well broke, and mix'd in along with it. Whence it rarely fails to exercise the skill of the *Rectifier*, either to get out this Oil, or break it finer; so as to render the natural flavour of the Spirit less sensible. But when care has been used by the Malt-Stiller, both in his first and second drawing, he often leaves his Spirit more grateful, than it comes from the hand of the coarse Rectifier; who, instead of separating the nauseous Oil, frequently fixes it faster; and, at the same time, destroys the native Vinosity of the Spirit, left in it by the *Malt-Stiller*.

But when the *Rectifier* also performs his part *Rectified*.
 masterly, the Spirit receives considerable improvement under his hands; for thus, by means of his Salt, and a gentle way of working, he keeps back much of the gross Oil: then also leaving out the Faints, and making up with fair Water in their stead, he renders the Spirit purer, more
 I 2 dilute,

dilute, and thin; without that hanging *Proof*, which, instead of being coveted, ought never to appear in *Malt-Spirit*; where the Oil is so exceedingly nauseous, faint, and disagreeable.

*Restored to
its Vinosity.*

But this kind of *Rectification*, especially where fix'd Alkaline Salts are used, being always apt to destroy the pungent, acid Vinosity; and in its stead introduce an urinous or lixivious flavour; several Methods are practised, of giving an artificial Vinosity in lieu of the natural one, lost in the Operation. The principal Methods in use for this purpose, turn upon *Spirit of Nitre*; either the *strong*, or the *dulcified*: By means whereof, they make their rectified Malt-Spirit into a dilute and weak *Spiritus Nitri dulcis*. Sometimes they put a sufficient quantity of the *Spiritus Nitri fortis Glauberi* into the Still, along with the Spirit to be drawn over: and this method is supposed to make the Vinosity more lasting, or not apt to fly off; as 'tis usually found to do in a few weeks after the bare addition of *Spiritus Nitri dulcis*, to a parcel of Spirit. And this being a Phænomenon, whereon a good deal depends, with regard to the improvement of *Distillation*; it may not be amiss to examine a little narrowly into it: for perhaps the Distillers could not well have hit upon a thing less prejudicial to health, or better fitted for their purpose, if its effects were durable: for, when used in a proper dose, it gives a most agreeable, and true Vinosity to a well cleansed Spirit; at the same time that it coincides with the nature thereof, and promotes its medicinal virtues, as a Diuretic, Deobstruent, and Lithon-
triptic.

The observations that have occur'd to me, as to the use of this fine, volatile Acid, upon rectified Malt and Melasses Spirits, are principally these.

1. That there is a great difference in *Spiritus Nitri dulcis*, according to the manner of its preparation; such being more apt to fly off, as has been least incorporated by Digestion, or repeated Distillation.

2. That any rectified, clean *Spirit*, impregnated with a proper dose of the common sort of *Spiritus Nitri dulcis*, and kept close stopp'd in a Glass; will very long retain its agreeable Vinosity.

3. That the Casks, long used to receive rectified Spirits impregnated with this artificial Acid, appear yellow, and rotten on their inside; like a Cork corroded by the fumes of strong *Spirit of Nitre*. Whence 'tis manifest, why the Vinosity is sooner lost in a Cask, than a Glass.

4. That when the inflammable Spirit has been rectified from fix'd Alkalies, it requires a much larger dose of the Spirit of Nitre, to impregnate it with this acid Vinosity; which also, is here lost so much the sooner, as the Spirit was more tartarized, or alkalized. And accordingly it usually remains longer with Melass, than with Malt-Spirit; the latter, from the fix'd Salts plentifully used in its Rectification, being commonly render'd the most alkaline.

5. That the best way of making this volatile Acid, whether with, or without external heat, is not usually practised; viz. so as to render it a perfectly homogeneous and unflammable Liquor: whence it proves much more volatile than it ought to be. Thus when perfect Alcohol, and a well rectified, strong Spirit of Nitre are, by degrees, put together, for the making of this vinous Acid; one half of the mixture evaporates, or may be made to distil in the violent conflict arising in the Operation, so as to leave the other half more fix'd.

6. The common Method also is improveable, by using in the Preparation, a Spirit of Wine impregnated with some certain Ingredient of a fine flavour, without much Oil ; for Acids do not mix with Oils, in any considerable proportion.

7. That in the Preparation of this dulcified Spirit of Nitre, the longer it stands in digestion with the Alcohol, the milder it grows; by which means also even the violently corrosive and acid Oil of Vitriol may be blunted, and render'd almost undistinguishable.

8. In fine, a particular *Spiritus Nitri dulcis* has been made more effectual than the common, and not disposed to quit the Spirit, otherwise than the native Acid is to quit *French Brandy*; which in time it always seems to do: though this be principally owing to a slow and secret Digestion; whereby the Spirit, the Water, the Acid, and the Oil become more intimately united, and the compound Liquor less pungent.

These Observations seem to clear up the whole Business, and render it practicable to better advantage; so that Distillers need not be obliged to pour their *Nitre*, as they call it, into the Spirit, only a few days before they send it away; for fear the Sophistication should be discovered e'er the Goods are consumed. No certain Rule can be laid down for the quantity in which this Acid should be employ'd, because different Spirits require different Proportions; let it only be noted, that too large a Dose is not only disagreeable, but renders the Imposition easily discoverable. And whoever endeavours to cover a foul Taste, by using a large Proportion of it, will, upon appealing to good Judges, find himself deceived: its proper Use being only to give an agreeable Vinosity; not unlike to that

that naturally found in all fine and thin subtile Spirits, drawn from fermented Liquors or Wines.

When the Spirit has been well rectified, 'tis usual *Coloured,* to find it incapable of affording the common Bead or *Bubble-Proof*; especially before it has received its proper Dose of colouring: by means whereof, they can, at the same time, give this *Proof-Spirit* any degree of a yellow, from a light lemmon, or straw-colour, to a deep brown, according to the fancy of the Customer. This *Art of Colouring* was first introduced, from observing that all *Brandies*, which by long lying in the Cask, had acquired a mellow Softness and Ripeness, appear'd of a yellow Cast. Whence it was supposed, that part of the particular Excellence of *French Brandies* depended upon this colour; which was therefore studiously endeavoured to be artificially communicated to the rectified Spirits, intended to resemble them.

For this purpose many things were tried; of which the principal and most famous at present are *Logwood*, *Saffron*, *Japan Earth*, *Treacle*, *burnt Sugar*, and *Oak*. The three former however have but little to recommend them; tho' they are not without their advantages, when properly applied; but the *Treacle*, the *burnt Sugar*, and the *Oak* are very good things for the purpose.

Treacle gives a fine colour, not much unlike the natural one of foreign *Brandies*; and being necessarily used in a pretty large quantity, as its colour is but dilute, it not only mends the *Bubble* or *Bead-Proof*, impair'd by Rectification; but also gives a Fulness in the mouth: both which Properties in Spirits are found very agreeable to the Vulgar; the chief retail Consumers of these coarse Goods.

Burnt Sugar, that is, *Sugar* dissolved in a little *Water*, and scorched over the *Fire*, till it turns black, goes much farther in tinging than *Treacle*; and gives no Sweetness, but rather an agreeable Bitterness; and thus recommends itself to the nicer Palates, that are not for a luscious Spirit: And to say the truth, *Sugar* thus treated tinges to perfection; with all imaginable Cheapness and Expedition.

But of all the Ingredients used to give a Colour, nothing is so natural as *Oak*; this being indeed the very thing to which the Colour of the *foreign Brandies* is owing; viz. the Colour they unavoidably acquire by long lying, and dissolving the resinous parts of the Cask. And this Ingredient it is that particularly fits them to sustain some trials, which other Spirits wanting, are unable to stand. *Common Spirit* poured upon *Oak-shavings*, and digested in a moderate Heat, easily fetches out this resinous Matter; which however goes nothing near so far in tinging as *burnt Sugar*. So that a large quantity of Shavings being necessary to colour a small parcel of Brandy, 'tis proper at all times to have an *essential Extract* of *Oak* ready at hand; that may be used occasionally. But however feasible and easy such a Preparation may appear, the Success will not answer without some Caution. Every Distiller may burn his own *Sugar*; but every one cannot prepare the *liquid essential Extract* of *Oak*. The Foundation of the thing lies here; that 'tis Brandy, not *Water*, or *Alcohol* alone, which is colour'd by the Cask: So that he who would not miscarry, must use two Menstruums, or *Alcohol* and *Water*; each whereof, with a slight Digestion, will extract a separate Part: both which, after due Exhalation,

halation, must be added together, and intimately mix'd with a proper Liquor, so as to keep the two parts from separating; as they otherwise wou'd do into a grosser, terrestrial, and a lighter, unctuous or balsamic Part. To prevent which the more effectually, a proper saccharine Intermedium might also be used. But the great Desideratum in the Business of *Malt-Spirit*, is not a Method of giving a fine Vinosity, and a natural Colour; but a Method of permanently and effectually cleansing it: which we have above attempted.

The most commodious State for Malt-Spirit *Alcolized.* to be preserved in, we have already observed to be that of *Alcohol*. And how it comes, that this Practice is not more general, let the Dealers and Merchants consider: for as the Case now stands, to import or export a Piece of entire Spirit, they really import or export along with it a Piece of fullsome Water, that might be much better supplied out of every River. But when a well rectified Malt-Spirit is brought into *Alcohol*, 'tis then in a pure State, at all times fit for the Uses of a *Spirit*: which cannot be said of Proof-Spirit, though of double the Bulk of Alcohol; because the Water in the Proof-Spirit unfits it to burn or feed a Lamp, dissolve Rosins, make Varnish, and many other particular Tinctures, Solutions and Mixtures: whilst Alcohol is as readily mixed into Punch, or made into other cordial Liquors, as *Brandy*; and that with a greater degree of Certainty, in point of Strength as well as Purity.

There being no cheaper Spirit usually made *Lower'd.* than that of Malt, no great Attempts are on foot to imitate or adulterate it: though 'tis said, that in *Poland, Denmark, Norway, Sweden, Guinea,*
 &c.

&c. a Corn-Spirit is, thro' Use and Custom, preferr'd by the *Rusticks* and *Savages* to *French Brandy*. The principal Sophistication whereto 'tis liable, is the Admixture of Water; and it seems generally allow'd in a Retail way, to dash an eighth thereof with *Proof-Spirit*: And if any have the Address of doing this, yet make the Spirit retain its Proof; they may very easily impose upon those who have nothing but the *Bubble-Proof* to trust to. Such an additional quantity of Water, makes the Spirit taste softer and cooler; for which reason many prefer it to the stronger, which is hotter: but unless the Spirit so served, be tolerably clean, or its Proof otherwise preserved; this additional Water sets loose the essential Oil; which will now leave a nauseous Farewel in the mouth. If rectified Spirits must needs be purchased in the ordinary way of *Bead-Proof*; that which goes off in pretty large Bubbles shou'd be chose; provided it otherwise appear clean, thin, and light; tastes soft, uniform; and is not high-flavour'd, alkaline, acrid, or fiery, but soon quits the Tongue.

*Used in
Mixture.*

The fair Uses of *unrectified*, *rectified*, and *double Malt-Spirit*, are things known and familiar; but the clandestine Uses, which are various, skulk in few hands. A principal one of this latter kind, is to mix it with dearer or foreign Spirits: but so coarsely is the *Malt-Spirit* commonly prepared and rectified, that a nice Palate will readily distinguish a tenth part of it mix'd in *French Brandy*, and much sooner in *Arrac*. However, some do venture upon a third, yet hope to escape undiscovered; and in effect they frequently do; from a previous knowledge of the Taste of their Customers. A certain Mark of so gross an Imposition is the urinous Scent and Taste;

Taste; which on account of the fix'd Salt, commonly predominates in such adulterated Brandy; and which is no way natural to the genuine. And indeed, all *Brandies* are to be suspected, that have not an uniform taste, and grateful odour; for I never yet cou'd find any Spirit rectified in *London*, but what had some particular, predominant, compound Flavour, given it only to cover and conceal that of the Malt. But one of the best, and most infallible ways of discovering any considerable Adulteration with a foul Spirit, is to burn away all that is inflammable; and carefully examine the remaining Phlegm, both by the Eye, the Nose, and the Tongue: for in this case, a small proportion of Oil may manifest itself, and easily betray its Origin.

But these ways will not serve to catch an Artist; and should the Distillers, as by proper Application they certainly may, once arrive at perfection in the Business of Rectification, a much larger Mixture than they now make, might escape unperceived. And when they are advanced thus far, 'tis but another Step, and they may give us as good *Brandy* from Malt, as that of *Bordeaux*, *Rochelle*, or *Cognac*.

HISTORY OF MELASSES SPIRIT.

What regards the original Production of a *Melasses* Spirit from *Treacle*, has already been consider'd, in general, under the Articles of *Brewing*, *Fermentation*, &c. We have only here to add, that unless some particular Improvements be made in the Subject; or some particular Encheiresis used in the Treatment; the Spirit will not prove so vinous as that of Malt, but more flat, or less pungent and acid; though otherwise much cleaner tasted; as its essential Oil is of a less nauseous Flavour: whence, if good fresh
Wine-

Wine-Lees, abounding in Tartar, be duly fermented in the Solution, made thin for the purpose; the Spirit acquires a considerable Vinosity and Tenuity, approaching to that of *French Brandy*.

By Rectification.

This Spirit ought likewise to be artfully rectified, with the Cautions before given; but alkaline Salts do not suit it: so that if any Salts are used, they should rather be neutral than alkaline; such as *Sandiver*, *common decrepitated Salt*, *Sal Enixum Paracelsi*, &c. though nothing so considerable is to be expected from these neutral Salts, as from a careful Rectification *per se*, in *Balneo Mariæ*: by which Operation alone, repeated once or twice with fresh Water, this Spirit may be very well cleansed, and fitted for the finest Uses.

By Mixture.

When brought to the Form of a *Proof-Spirit*, if it have not naturally enough Vinosity, a good *Spiritus Nitri dulcis* suits it extremely: and if the Spirit be clean work'd, it may by this Addition alone be made to pass on ordinary Judgments for *French Brandy*.

How coloured.

The Methods of colouring it are altogether the same with the colouring Malt-Spirit*; but *burnt Sugar*, or rather the *essential Extract of Oak*, seems most homogeneous and natural to it.

Adulterated.

This Spirit is frequently, and indeed sometimes shamefully adulterated with that of Malt; and 'tis extremely difficult to buy it without a Dash thereof: or if they assure you 'tis not mix'd with Malt-Spirit, they commonly have this Salvo, that Malt was originally used in the Fermentation; and so the Spirit itself was produced in the state of Mixture.

* See Pag. 119.

Great Britain seems the principal seat of this *Where made.* Commodity: it was formerly prepar'd in great plenty in *France*, especially up the River *Loire*; but 'tis now forbid, under a severe penalty. In *Holland* likewise they have it not; on account of the high Duty laid upon the importation of *Treacle*, in favour of their own Sugar-Bakers.

We meet with very little of this Spirit any *Its Uses.* where in the form of *Alcohol*; tho' when reduced thereto, in a proper manner, 'tis little inferior to the real *Alcohol of Wine*: and should be the thing in general use with our Compounders, Chemists, and Apothecaries.

Its principal uses are to mix with *Rum*, *Arrac*, and *French Brandy*; for, if well prepared, it cannot, in a tolerable proportion, be distinguished in them. 'Tis also of itself a pleasant Dram, and serves very notably to make Punch, and the finer compound or cordial Waters. And there are those, who for *Cherry-Brandy*, and the like Drams, by Infusion, &c. prefer it to a true *French Spirit*: so that in most nice Cases it supplies the Defect of a clean Malt-Spirit; which cannot be commonly procured. Thus *Citron-water*, *Cinnamon-water*, &c. are usually made with it in *England*; in which Compositions, our ordinary rectified Malt-Spirit would taste very disagreeable, and spoil the whole.

There is another particular Use of this Spirit, which none of those that have any high flavour, not *French Brandy* or *Arrac*, answer so well: And tho' the thing may seem but a trifle, both Pleasure and Profit have attended the Experiment. 'Tis a Method of making a kind of *extemporaneous Wine*, without Fermentation. The Secret is, to slice good sound Lemmons, and infuse them, rind and all, for but two or three days, in fine *Melasses Spirit*; then to strain out the
Liquor,

Liquor, filtre it, and having made a very thin Syrup of the purest Sugar, dissolved in Spring-water, mix them well ; and if the Proportions are hit, (which is not difficult to do) it makes a most grateful vinous Liquor, not inferior to some foreign Wines.

Its Yield. A hundred weight of good rich *Treacle*, may, according as 'tis managed, produce from four to seven Gallons of *Alcohol*.

Uses of the Still-bottoms.

The *Still-Bottoms* of *Melasses* are successfully used to scald and recover musty Casks ; to cleanse and brighten Brass-Wire, and rusty Copper-Ware ; and may be applied to many purposes where washing and scouring with *Argol* is proper. Mr. *Boyle's acid Spirit of Wine*, or a Spirit very like it, is also hence procurable ; so likewise is a matter analogous to *Becher's Media Substantia Vini*. And probably this Liquor may be serviceable in dying ; for it gives a durable yellow stain to the hands, and other animal substances. The use above-mention'd of *Malt-wash*, holds equally of this ; viz. that a quantity of it may be advantageously added to a new parcel of *Treacle*, design'd for fermentation. And whether the *Vinegar-Maker* can find no use for it, I leave him to consider.

HISTORY OF SUGAR-SPIRIT.

Sugar-Spirit, what, and how prepared.

By *Sugar-Spirit* is here understood, the Spirit prepared from the Washings, Scummings, Dross, and Waste of a *Sugar-Baker's* Refining-house.

These drossy, or refuse parts of *Sugar*, are fermented with Water, in the usual manner ; then distil'd into a Spirit, and rectified *per se* to vulgar proof. When the Operation is well perform'd, and no foul, or fetid foreign matter has got among the Wash ; this Spirit appears tolerably clean, especially in *England* ; but in *Holland*, where

where they also prepare it, 'tis usually very nau-^{Its Rectifi-}
seous and disagreeable; tho' capable, by an easy ^{cation, and}
Rectification, little known abroad, but familiar ^{Uses.}
with us at home, of being brought into a clean
wholesome Spirit; fit to mix with foreign *Brandies*,
and even *Arracs*, in a large proportion,
without being much subject to discovery. But
as the *Dutch* leave this Spirit so coarse, they can
use it for little else besides mixing with *Rum*; and
even there 'tis discoverable, if ever so little over-
dosed.

When this *Spirit* is prudently brought into *Alcohol*,
it seems superior to that of *Treacle*: which
affords a very useful Hint; the prosecution
whereof belongs to another place.

No farther notice need be taken of this Spirit
at present; because, in other particulars, it co-
incides with *Melasses*, *Malt-Spirit*, and *Rum*; to
which we refer.

HISTORY OF WINE-SPIRIT.

By *Wine-Spirit* is generally understood a *Spi-* ^{Wine-Spi-}
rit produced in *England*, from *Wines* that grew ^{rit, what,}
abroad. ^{and how}
^{produced.}

The way of producing it, is by common
Distillation; with no more Rectification, than
will bring it to a *Bubble-proof*.

The Yield of *Wines* is different, according to
their Nature; but commonly plays betwixt an
eighth and a fourth of Proof-Spirit: that is, they
will yield from a sixteenth to an eighth of their
own quantity in *Alcohol*.

The *Wines* that are a little prick'd, prove
never the worse for this purpose; as giving, in
that case, a greater Vinosity to the Produce:
which Vinosity is a very valuable property in a
Wine-Spirit; whose principal use is to mix with
another that is tartarized; or a *Malt-Spirit*,
render'd

render'd alkaline by the common Method of Rectification.

*Its difference
from Brandy.*

All the *Wine-Spirits* made in *England*, even those from *French Wines*, appearing to differ greatly from the common *French Brandies*, has impress'd a strong notion in our people, that there is some concealed Art practis'd in *France*, with relation to their Brandies: but this suspicion has no real foundation, as we shall manifest, when we come to treat of *French Brandies* in particular. In the mean time, let it be observ'd, that, by our usual way of distilling *Sicilian Wines*, or *Spanish Wines*, we do not produce *Spanish* or *Sicilian Brandies*. The true reason is, because the Wines exported from abroad, are of a very different nature from the Wines they distil for Brandy upon the spot; the latter being so poor, and thin, as not to stand even a few months, or keep from turning eager upon any considerable Voyage. But if we had in *England* those poor thin Wines they distil for Brandy near *Bordeaux*, *Cognac*, or up the *Loire*, no question but the *Wine-Spirits* produced from them, would be generally allowed *French-Brandies*, in every respect. And in fact, from the thin, prick'd, and damaged *French Wines* receiv'd in *Scotland*, they do, by bare Distillation, produce Brandies so nearly approaching to those of *France*, as to be allowed for such. *Wine-Spirits* and *Brandies* therefore are the same thing; with this difference, that *Wine-Spirit* is the Spirit of a rich Wine, and *Brandy* the Spirit of a poor one: or, at most, they differ only as a *Cyder-Spirit* does from a *Crab-Spirit*.

Its Uses.

This *Wine-Spirit* is not easy to be bought pure, and unmix'd, at the Distillers, nor under a price almost equal to that of *French Brandy*. So that if ever it be required, out of the Trade,

it

it might be as well to use *Brandy* in its stead: which will always serve the purpose; unless a high flavour, or a copious essential oil be expected. For, contrary to the nature of other *Spirits*, this is coveted for its oil; as being chiefly intended to cover, conceal, or disguise a fouler Spirit than itself.

Sometimes, however, this *Spirit* is prepared in the way of good husbandry at home, when a parcel of wine happens to be spoil'd; or any quantity of Lees remain at the bottom of a Cask. In which cases the high flavour being not usually required, the Spirit should be drawn off with great gentleness, either in *Balneo Mariæ*, or otherwise; and may afterwards, if there is occasion, be rectified *per se*, or with fresh water, to the desired degree of purity.

Nearly of kin to this *Wine-Spirit*, is that prepared from *Raisins*, fermented only with water; for thus they yield a Spirit hardly distinguishable from some kinds of *Wine-Spirit*; there being as many kinds of *Wine-Spirit*, as there are of Grapes. And the nearer will be the resemblance, the coarser the operation is perform'd; that is, after the usual manner of the Distillers, throwing up as much essential oil as will rise with a galloping heat. And thus in defect of their favourite *Wine-Spirit*, they may easily have one that will cover as much as that. And in the business of covering, 'tis surprizing to what a length this kind of Spirit will go; in-
Raisin Spirit like it.
somuch that ten Gallons shall sometimes give a determining flavour to a whole piece of ordinary *Malt-Goods*: whence proceeds the great value which is set upon this *Wine-Spirit*, by the Distillers and ordinary *Rectifiers*; whose imperfections it is a good cloak to conceal. We cannot therefore desire this Spirit to be brought to the form

of *Alcohol*; for that would take off from its intended Virtue and Use: as, on the contrary, those who employ it only as a Cover, might either keep it in the form of Low-wine, or at least skim off the flavouring oil, before the Spirit is rectified to *Proof*. In other respects, this Spirit is the same as a real *Brandy* *. *Cyder-Spirit* is also of the like general nature; and obtain'd in the very same method. But as its particular flavour is not so desirable, it may, by care, be render'd very pure, and almost insipid, upon rectification; and in this state, it might advantageously be used in mixing with other Spirits, or imitating the finest Brandies of *France*.

*Uses of the
Still-bottoms.*

The *Still-bottoms* of Wines may be brought to afford Mr. Boyle's *acid Spirit of Wine*, *Becher's media Substantia vini*, a parcel of Tartar to great perfection; and at last the Remainder may be turned into genuine *Salt of Tartar*. This Liquor might otherwise be serviceable in the making of Vinegar and white Lead.

HISTORY OF BRANDIES.

*Brandies,
what.*

Brandies, in the strict sense of the word, are nothing more than *Proof Spirits*, obtained by simple Distillation from real *Wines*, or the fermented Juice of Grapes.

In the general sense, they include all kinds of spirits considered in a State of *Proof*; or as consisting of an equal weight of Water and Alcohol.

The French.

The Brandies of *France* being in the highest repute, we shall confine ourselves principally to the consideration of these.

The *French Brandies* most generally esteemed are produced up the *Loire*, or near *Cognac*, *Nants*, and *Rochelle*. Next to these, are the *Bordeaux*, or
entre

* See Pag. 131.

entre deux Meres Brandies ; those of *Languedoc*, and the Islands of *St. Martin*, *Oleron*, &c.

According to the different Species and Growth of the Grapes, the Brandies always differ ; whence there are various kinds of *French Spirits*, having particular flavours ; by which the *Conoisseurs* readily distinguish one sort from another : though the vulgar call them all by the name of *French Brandy* indiscriminately. But an ordinary judgment may easily distinguish *Languedoc Brandy* from that of the Isles ; or *Bourdeaux* from *Cognac*. Nor would there be so great a similarity between the several species of *French Brandies* as there is, but that only the weakest and lowest-flavour'd Wines are distill'd for their Spirit ; or such as prove absolutely unfit for any other use. But, when, out of curiosity or good husbandry, they distil the bottoms, or refuse parcels of the grosser-bodied and fuller-tasted Wines ; the *Brandy* got from them, is what we in *England* emphatically call a *Wine Spirit**.

Every kind of Grape therefore, as it affords a Wine, so does it also a Brandy of its own peculiar flavour : which is an observation that should be well attended to when any parcel of *French Brandy* is proposed to be imitated ; for 'tis ridiculous to expect *Cognac Brandy* should be perfectly resembled with a Quintessence made from *Bourdeaux Grapes* ; though the Spirit, or subject matter of the operation, were previously rendered ever so pure or tasteless.

A large quantity of Brandies is made in *France* during the time of the Vintage ; for all those poor Grapes that prove unfit for Wine, are usually first gathered, pressed, and their juice fermented, and directly distill'd. This rids their hands of their

Whence the large quantities of Brandy in France.

* See pag. 127. &c.

poor Wines at once; and leaves their Casks empty for the reception of better. 'Tis a Rule with them to distil no *Wines* that will fetch any manner of price as *Wines*; for in this state the profits upon them is vastly greater than when reduced to Brandies. This large stock of small Wines, wherewith they are almost over-run in *France*, shews the reason of their making such vast quantities of Brandy, more than other Countries, which lie warmer and better for Grapes.

But this is not the only Fund of their Brandies; for all the Wine that pricks, or turns eager upon their hands, is also condemn'd to the Still; and, in short, all that they can neither export nor consume at home: which amounts to a large quantity; since much of the Wine laid in for their family provision, is so poor as not to keep the spending.

How made. Their general method of distilling *Brandies* in *France* needs no formal description; as not differing from that vulgarly practised among ourselves in working from Wash or Wines: nor are they one jot more cleanly or exact in the operation. They only observe more particularly, to throw a little of the natural *Lee* into the Still, along with the Wine; as finding this gives their Spirit the flavour, for which it is generally admired abroad; though not at all by themselves at home: who have a most contemptible opinion of Brandy in general; but especially the high-flavour'd kinds. So, that as the distillation of this commodity is usually left to the meanest and most servile hands amongst them; the Spirit itself is very little used by any other sort of people throughout the kingdom.

Their notion of Proof squares with ours to a tittle, and they stand upon it to a *Puntilio*; as if the

the whole excellence of the Brandy lay there. And in this form of strong bubble-proof all their fine Spirits are constantly found.

But they have one particular expedient for such Brandies as prove foul, seedy, or retain the taste of certain weeds apt to grow among the Vines; viz. to draw them over again, with a design to cleanse them of that adventitious flavour. In which operation they leave out the *Faints*, or rather change the Receiver as soon as ever the stream comes proof; then mixing together all that run off before, they call it by the name of *Trois-cinque*; that is, Brandy consisting of five parts Alcohol, and three of Phlegm.

Higher than this the *Bruleurs*, or common Distillers, in *France* seldom bring their Brandies; that refined nation having the address to persuade the foreign Merchant that the phlegm of *French* Brandy is a natural part, as essential to it as the Body to the Soul. The truth is, if people were so disposed, they might easily reduce *French* Brandies, or the Brandies of any other Nations, to half their usual bulk, without impairing their virtues: For if the essential oil of the wine be the thing required, this is much better preserved in Alcohol than in *Proof Spirit*. But whether the charge of bringing Brandies into *Alcohol*, would exceed that of a double freight, and double stowage, is the Merchant's business to consider; or whether it be not proportionably as advantageous to import *Low-wines* as Brandies; which, with respect to *Alcohol*, are nothing but a stronger *Low-wine*.

They use no manner of Art to colour their Brandies, nor to give them any additional flavour; the thing they principally value themselves upon, both in Wines and Brandies, being to

make them *perfectly natural*; so that all the colour of their Brandies is acquired from the Cask, and the length of time they usually lie therein; which is sometimes twelve or eighteen months, and often two or three years: during which, 'tis no wonder if they acquire a yellow or brownish cast. Their lying thus long, as it were in a state of slow digestion, wonderfully takes off from that hot, acrid, and foul taste, peculiar to all *Spirits* or *Brandies* newly distill'd; and gives them a coolness and a softness not easily to be introduced by art, without great care being had in the first operation. But these fine and grateful Brandies, as they prove after having lain thus long, were at first hot, acrid, foul and fiery. This fine colour, and an agreeable softness or coolness in the mouth, going along with *French* Brandies of a good natural flavour, are the things that principally recommend them to the judicious purchaser.

Ways of examining the goodness of Brandies.

And upon these properties are founded several methods of trying their goodness, or discovering whether they are debased or adulterated by the admixture of coarser *Spirits*. But there is little danger of any such practice in *France*, as they have no cheaper *Spirits* to debase or adulterate their *Brandies* withal; especially since the prohibition of *Melasses Spirit* in that Country. And the same reason, in good measure, holds in favour of the *Dutch*; who, tho' generally suspected as great Adulterators, yet in this case seem but little qualified for it; as having no *Treacle Spirit*, nor a good *Spirit of Sugar*, current among them. And as for their common *Malt-Spirit*, they seem to have no hopes of rectifying it; as being so intolerably fetid and nauseous, that almost a single Gallon would taste thro' a whole Piece of

of Brandy. All therefore that the *Dutch* seem fitted to do in this case, is to mix Brandies with *Wine-Spirits*, or the Spirit drawn from *Wine Lees*, which they have in very great plenty. But even this cannot be very gainful, considering how cheap the Brandies are in *Holland*; for paying no duty, they come almost as cheap there as in *France* itself. The temptation to adulterate *French Brandies* is much greater in *England*, where the Duties upon them are high; tho' they are also very much adulterated up and down the *Continent*, and all considerable trading Towns and Sea-Ports. In *England*, as has been above observed, they use all kinds of Spirits to mix with them; *Malt*, *Melasses*, *Cyder*, *Sugar-Spirit*, &c. and often do it so dextrously, or so sparingly, as vulgarly to pass undiscovered. The same arts are likewise practised in many other Countries; but certain Brokers, Factors, and Under-Merchants, who deal largely in Brandies, are said to have a particular Liquor, which being added to a Glass of any suspected Brandy, will shew by the colour it makes therewith, whether, and in what proportion the whole parcel is mix'd with a *Corn-Spirit*. But such proof is erroneous, and not to be trusted. The fact is this. If a few drops of a *certain vitriolic Solution* be let fall into a Glass of old *French Brandy*, it will, if the vitriolic Solution were rightly prepared, turn the Brandy of a fine purple, or deep violet colour: by the strength or diluteness of which colour, they judge the *Brandy* to be either pure, or mix'd with a *Malt Spirit* proportionably. The foundation of the thing lies here. Old *French Brandy*, by having long lain in an oaken Cask, thus really becomes a dilute *Tincture of Oak*; which upon the addition of the vitriolic Solution, necessarily

turns of a blue colour; after the manner that *Ink* is made of a Tincture of Galls and Vitriol. But if the *Brandy* be perfectly pale, or very lately distill'd, it will not thus change its Colour, upon the addition of the Solution; tho' the *Brandy* were totally *French*. And in the same manner a light Tincture of Oak, extracted with Malt-Spirit, or any other Spirit; will, upon affusion of the same Solution, exhibit the same appearance. Hence this kind of proof is nothing more than a way of determining how rich a Tincture of Oak any common Spirit or Brandy is. *Calcin'd Vitriol of Iron*, lightly infused in a certain dilute, or *aqueous mineral acid*, gives this *Solution* to great perfection; being, when well made, of a fine yellow colour, and capable of giving, for a season, the finest blue to a spirituous Tincture of Oak. And here, it may not be amiss to mention, that the Experiments I formerly made of this kind, led me at the first sight of Dr. *Eaton's Styptic*, to conjecture the manner of its preparation; which, upon a second attempt, I hit to great exactness. I should not mention so small a matter, if the discovery of that famed Styptic had not been somewhat unsuccessfully attempted by others; so far, I mean, as concerns the appearance and Phænomena, tho' not, perhaps, the virtues of it. The whole secret is this. To a parcel of old *French Brandy* add a very minute proportion of *calcin'd green Vitriol*; and thus there will presently be made a dilute Ink, which very slowly deposits a black or dusky cloud, that afterwards rests at the bottom of the Glass, and causes the liquor to exhibit all the phænomena, and answer the ends of Dr. *Eaton's Styptic*.

To proceed, 'tis manifest that *French Brandies* naturally receive their colour from the Cask. The discovery of which particular, might probably

bly be the reason why high-colour'd Brandies have of late years sunk in the esteem of many, so as to occasion pale ones to be much order'd ; and for a while, nothing would go down but pale Brandies. Hence, both in *France* and *Holland*, they fell to work upon redistilling their old Brandies, to make them of a water whiteness. And to such a length this humour run, and the difference in price between pale and brown Brandies grew so considerable, that much profit was made in *Holland*, barely by the redistillation of Brandies, to render them colourless. This also made very well for *France* ; who had much rather dispose of her new *colourless* Brandies, for an advanced price, than for a lower, after having kept them in a wasting state, to colour them, many months in the Cask : which colour, where not artificially introduced, is a sure sign of age, that is, excellence on the side of Brandy.

The vulgar method of examining Brandies by the *Bead-proof*, may be of good service, in procuring such as will best serve to mix with, and conceal an ordinary Spirit ; as this proof, when strong, shews they contain a good deal of the essential oil of the grape, which gives an agreeable flavour. But when intended for other curious or chemical uses, as much labour is often employ'd to get out this fine-tasted essential oil in *France*, as the more curious chemists employ to get the fetid oil out of Malt Spirit in *England* : and indeed there are many operations where the nidorous odour of either Spirit would be very unsuitable ; nor is it often proper to use a menstruum to act upon one body, whilst it is already saturated with another. But no judgment can by this kind of proof be formed of Brandies, as to their mix'd or adulterated state.

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The surest way for this purpose, is, to acquire the habit of judging from use and practice. The taste and smell, are, by proper Methods, so far improveable in this particular, as not to be easily imposed upon. Care indeed must be had, not to taste Brandies in too high a state; for this scorches the mouth, and confounds the judgment. Nor should many sorts be tasted soon after one another: for thus a mixture of tastes will be made; the taste of the preceding being not yet gone off the tongue.

*How to be
imitated,
and cleansed.*

The best Method is to dilute *Brandies* well with Water, in order to their being smelt, and tasted; or rather, as was mention'd above, to burn away all their inflammable Spirit, and afterwards examine the Phlegm.

From this History of *French Brandies*, compared with the foregoing doctrine of simple Distillation, and Rectification; it will appear, that many of our *English* Spirits are convertible into *Brandies*, that shall hardly be distinguished from the foreign, in any respect; provided the Operation be neatly perform'd. And, in particular, how far a *Cyder-Spirit*, and a *Crab-Spirit* may, even from the first extraction, be made to resemble the fine, and thin *Brandies* of *France* we would recommend to the practice of those Distillers, who have any skill, and curiosity this way.

To the same curious persons we would also recommend the Discovery of that *Desideratum*, in the business of rectifying *French Brandies*, which the Distillers in *France* and *Holland* scarce know how to attempt; tho' it would be a profitable business in either Country. By this Rectification is meant, the Method of clearing *Brandies* from a certain seedy Taste, with which they are frequently impregnated; and, upon which account, they cannot find purchasers, but upon disadvantageous terms.

terms. Thus sometimes a Cask of *French Brandy* shall resemble *Aniseed*, or *Caraway Water*, rather than *Brandy*; so that the Proprietor, to get it off, is reduced to the necessity of mixing it among other Brandies; in such small proportions, as may render it undiscoverable: whereas, could he but clear it of this flavour, he might readily be re-imburfed, with a handsome profit.

The foundation for this kind of *Rectification*, is so fully laid in several parts of the present *Essay*, that our *English Distillers*, 'tis hoped, may, from thence, be enabled to effect the thing.

'Tis a mistake to imagine, that all the Brandies made in *France* are so good, and fine, as we usually taste them upon our Keys at *London*. No; there are many hundreds of pieces made every year, almost as disagreeable, and nauseous, as our *Malt-Spirit*. But the case is, they send the best Brandies, as they do the best Wines, to *England*; where they get the best prices for them. But in *Holland*, the Mart for Goods of all sorts, you shall sometimes not be able to pick a good piece of *French Brandy* out of fifty: the general run of them being either seedy, oily, musty, or otherwise infected with some unnatural and disagreeable flavour. And these are the sorts, which, in *France*, they despair of curing by re-distillation, or bringing towards the state of Alcohol, or to what they call *three fifts*.

These cases require a better Method of Rectification, than our common one, by fix'd Alkalies: but if due care, and skill were employ'd from the first gathering of the Grapes, to the making up of the Brandies; not only such inconveniences might be prevented, but the Brandies of *France* might, in general, be render'd much finer.

Some prefer *Rhenish Brandy*, to that of *France*; and particularly in *Holland*, it sells for double the price.

price. 'Tis indeed a very fine *Spirit*; but the *English* know little of it farther, than that a dash thereof serves to fill up a Cask of *French*.

The *Spanish* Brandies are much coarser than the *French*; tho' sometimes made to pass for them in *Holland*, and other places of great Traffic.

The *Still-Bottoms* of *French* Brandy are useful to all the purposes above-mentioned of the *Still-Bottoms* of *Wine-Spirit* *.

HISTORY OF RUM.

Rum, what. *Rum* is a Spirit procured from the fermented scummings, waste, and refuse matters of a primary *Sugar-House*; that immediately works the Sugar from the Cane.

Rum therefore differs from a *Sugar-Spirit*, as containing more of the natural flavour, or essential oil of the *Sugar-Cane*; a deal of the raw juice, and parts of the *Cane* itself, being often fermented in the Liquor, or Solution, whereof the *Rum* is prepared.

The unctuous flavour of *Rum*, is often supposed to proceed from the large quantity of fat used in boiling the Sugar: which fat indeed, if coarse, will commonly give a disagreeable, nidorous, or oily flavour to a Spirit; as I have found by experience: But *Rum* has its specific and natural flavour from the *Cane*.

How made. When a sufficient stock of these refuse Materials is procured, they are fermented in the common method; tho' always slowly at the beginning of the season of making *Rum* in the *Islands*, for want of *Yeast*, or other fermenting Matter, to set the Liquor at work. But, by degrees, they procure a sufficient quantity of the *Ferment*, which spontaneously rises as a head in the operation; and

* See pag. 127, &c.

and thus they come in a little time to ferment and produce their *Rum* with great expedition.

When the *Wash* is fully fermented, or to a due degree of Acidity; the Distillation is carried on in the common way, and the Spirit made up Proof: tho' sometimes advanced nearer to *Alcohol*, or the state of double Proof; in which case they call it *double distill'd Rum*.

It may be otherwise rectified to advantage; as *Rectified*, 'tis commonly first drawn, with a full dose of high-flavour'd oil in it, which requires to lie, or digest for a long time in the Spirit, before the whole becomes soft, and fit for use: whereas, were it to be well rectified, it would grow mellow much sooner, and have a much less potent flavour, which sometimes renders it disagreeable.

The best state to keep it in, both for Exportation and otherwise, is, doubtless, that of *Alcohol*; unless when the gross oil is required in it, for the sake of mixing and covering. And by duly throwing out its Oil, it may be brought nearly to the flavour of a fine *Sugar-Spirit*, or *Arrac*: as a very small proportion of it, used in its natural state, to a fine tasteless Spirit, will give it a flavour bordering very near upon that admired in *Arrac*.

This *Spirit* is usually very much adulterated in *England*, with one or other of the cheaper sorts; even a rectified Malt-Spirit, if used in moderation, much less a Melasses, or Sugar-Spirit, being not easily distinguishable therein.

The ways of trying its goodness, are the same *How assay'd*, with those already mentioned, for the examination of other Spirits. In this, and most other respects, it ought to be considered as a *Brandy* of a particular species: So that what is delivered in the foregoing Section of *Brandies*, will be also appli-

applicable to *Rums*. For tho' the *Sugar-Cane* differs from the *Vine*; yet the sweet saccharine substance, whereto both the Juice of Grapes, and the Juice of the *Sugar-Cane* are, by the same Art, reducible, fits them to afford Wines, and Brandies, that shall not be readily found to differ. Which is a pregnant Hint, that may be farther prosecuted in due time.

HISTORY OF ARRACS.

Arrac what. *Arracs*, properly so called, are Spirits produced from the fermented Juice of certain Trees, growing in the *East-Indies*.

Various contradictory accounts have been handed about, as to the real subject that gives origin to this fine spirituous Liquor: the vulgar supposing it to be *Rice*, others the Juice of the *Eastern Sugar-Cane*; others a mixture of this and the Juice of the *Toddy-Tree*: and others again take it for an artificial Preparation of the Flesh of Animals, and more costly Ingredients.

But, beyond dispute, the finer *Arracs* are made of the Juice of the *Cocoa-Tree*, or the *Palm-Tree*: tho' other trees also may afford Juices fit for the same purpose, or the making of *Arrac* particular: which is a general and familiar name in the *East* for all kinds of Brandies; as the word Spirit is with us.

How made. The Process of making *Arrac*, as I received it from more than one curious person, who had seen the whole work, is as follows.

The manner of collecting the vegetable Juice for it in the *East*, differs from our common way of tapping Trees in *England*. It seems the Operator, being provided of a sufficient stock of small Earthen Pots, with Bellies, and Necks, like our ordinary Bird-Bottles; he fastens a parcel of them

them to his Girdle, or otherwise commodiously about him; and thus equipp'd, swarms directly up the tall trunk of the *Cocoa-Tree*: when coming at the Boughs, he with a knife cuts off certain little Buds, or Buttons, and immediately applies a Bottle to the wound. And having thus applied, and dextrously supported his whole number of Bottles, as so many Receivers, for the Liquor to distil into, he descends. This is usually done in the *Evening*; the Tree bleeding more freely in the night. Next Morning the Operator takes off his Receivers, and empties them into a proper Receptacle; where, of itself, the Liquor spontaneously ferments. When the fermentation is over, the weak Wash, now grown a little tart or acid, is put into the Still, and drawn down to a *Low-Wine*: which is so very dilute and poor a Liquor, as soon to corrupt and spoil by keeping. For which reason, to make it stronger, they rectify it in another Still, to that very weak kind of *Proof-Spirit* we commonly find it; which, notwithstanding its being Proof, sometimes holds but a sixth, and sometimes but an eighth of Alcohol: all the rest being a poor Phlegm, or acidulated Water, valuable only for having been brought from *Goa*, or *Batavia*.

How this Spirit should come to appear Bubble-^{Whence its} Proof, and yet be really so far below what we ^{Proof.} commonly mean by Proof, might appear strange, if we had not already inquired into the nature of this kind of *Proof*; and shewn it, owing to a certain tenacity of the parts of the Liquor, or to the particular property of the Oil held dissolved in the Spirit. To this we may add, that the finer and more subtile any Oil is, the less it refuses to mix with an aqueous *Menstruum*; inso-much, that we see the essential Oil of some vegetables,

getables, at least a certain portion thereof, is so fine, and subtile, as to mix, without turning milky, even in pure Water itself: which is the case in many distill'd Simple Waters. Hence 'tis no wonder, that so subtile an Oil, as must naturally be contain'd in so thin and dilute a vegetable Juice as that which affords *Arrac*, should dispose it to mix with a Water animated by a sixth or eighth part of perfect *Alcohol*.

Sometimes there come into *England*, and very commonly into *Holland*, *Arracs* of the common *Brandy-Proof*; and sometimes above it: the frugality of the *Dutch* having taught them to spare some of the freight of so usefess a part, as the Phlegm of *Arrac* is. But why they do not go still farther, and bring it over in the form of *Alcohol*, is their business to consider.

*Its different
sorts.*

Besides the common sorts of *Goa* and *Batavia Arracs*, there are two others less generally known; viz. the *bitter* and the *black*. The *bitter Arrac* is supposed to have been impregnated with some rich *Bezoar*; as that of the *Porcupine*, *Cercopithecus*, &c. taken out of the Gall-Bladders of such Creatures. These stones will indeed communicate a bitterness, and are sometimes used in the *East*, to give that flavour to Punch: but others suppose the bitterness of *Arrac* not owing to any thing adventitious, but entirely to the nature of the Juice, that afforded the Spirit; as suppose the *Cachou-Tree*, or that which yields the bitter Juice, abusively called *Terra Japonica*.

The black *Arrac* is a very coarse Spirit, and usually drawn higher than the finer sorts; being not drank like them, but employ'd for coarse and ordinary purposes. And of kin to this black sort, seems to be the *Turkish Arrac*, or *Rackee*, as 'tis called.

Arrac,

Arrac, as it comes from abroad, is often apt ^{How clari-} to grow foul, and black, especially if the *Leager* ^{rified.} or *Cask* be any way decay'd; or the Liquor comes to touch any Nails, rusty Iron, or the like; which it presently dissolves, and thence, upon account of the Oak, turns inky. To whiten and clarify such foul *Arrac*, 'tis usual to put a large quantity of new, or skimm'd Milk, into the Cask; and work it about therein, as the Vintners do, in order to whiten their brown Wines. And when the bottoms are large, they commit them to a Conical Filter, of Flannel, whence the Liquor comes away fine.

This Art of purifying Arracs with Milk, ^{Adulcerated.} were tolerable, if they did not, at the same time, lower them with Water also; which is sometimes done, to a shameful degree: tho' the weakness of some genuine *Arracs* greatly contributes to countenance such an abuse. This, however, seems the principal debasement practis'd upon *Arracs*, among reputable Dealers; who are scarce ever furnish'd with another Spirit, tasteless enough to mix with *Arrac*, so as not to be discover'd by the chief Consummers of so dear a Commodity. And in *Holland*, 'tis usually sold so cheap, as not to be worth adulterating; tho' they had a proper Spirit for the purpose.

The extraordinary Price which *Arrac* bears in ^{Imitated.} *England*, has caused many attempts among the Distillers to imitate it; but generally without success: as they have commonly hoped to do it, for cheapness, with their own fulsome rectified *Malt-Spirit*.

There are indeed some certain ways of doing it to perfection; but whoever would succeed, must either know the method of making a tasteless Spirit; the Art of collecting and working some sweet, tho' otherwise tasteless Juices of Ve-

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getables;

getables; or else a certain Method of treating a peculiar, dry, pulverable Body, that is readily soluble in Water. This last Method is attended with the least difficulty, and greatest profit. But, however it may go with this particular; 'tis strange methinks we should no where meet with *English Arracs*: since we are furnished with so many Trees, capable of supplying them, as well as the *East*; particularly the *Birch*, the *Sycamore*, and the like.

S E C T. VI.

Of the Reduction of Spirits to their greatest Simplicity; and turning one Simple Spirit into another.

*All Spirits
reducible to
perfect Alco-
hol.*

HAVING seen, in the preceding Sections, how all simple Spirits are originally produced, rectified, and fitted for the common purposes of life; we come at length to consider, how they may be fitted for some uncommon, or more curious uses.

It has been shewn, that *simple Spirits* consist of four different parts; viz. *Water*, *Oil*, *Pblegm*, and *Alcohol*: the last of which is the essential part, or what denominates, and really constitutes the whole a Spirit. In reducing *Spirits* therefore to their utmost degree of simplicity, 'tis evident, that the three superfluous parts are to be got rid of, and the *Alcohol* left alone. By which means we shall procure a *Liquor sui generis*; or of many particular qualities, not to be found in any other Fluid. Among others, it has these remarkable pro-

properties. (1.) When absolutely purified, 'tis an *uniform* and *homogeneous Liquor*; capable of no farther Separation, without loss or destruction to some of its homogeneous parts. (2.) 'Tis *totally inflammable*, or burns away in a Vessel floating on cold Water; without affording any Soot, or leaving the least Moisture behind it. (3.) It has no specific or distinguishable Taste, Odour, or Flavour, any more than pure Water; except what is owing to its Nature as *Alcohol*, or perfectly pure Spirit. (4.) 'Tis an *unctuous*, yet *crispy Fluid*; being not only totally inflammable, but running veiny upon Distillation; whilst the Drops of it, falling into the Receiver, roll upon the Surface of the other Liquor, like *Peas* upon a Table, before they unite. (5.) It appears to be the essential Oil of the Concrete, broke fine, and intimately and strongly mixed with an aqueous Fluid, which is assimilated or changed in its nature by the Operation. (6.) And, lastly, it seems to be an universal kind of Fluid; or producible with the same properties from every vegetable Subject. But thus to produce it, requires care and exactness in the Operation.

This shews us the Foundation of a Method, *And thence easily to any kinds of Brandies, &c.* for reducing all simple Spirits to a perfect Similitude or Sameness; to which when they are once brought, 'tis no difficult matter to impregnate them with essential Oils; and thus turn *Malt-Spirit* into *French Brandy*; or if you please, *French Brandy* into *Malt-Spirit*; *Arrac* into *Rum*, and *Rum* into *Arrac*, &c.

The more practicable Methods of reducing *Alcohol* to this degree of Purity, have been *The Methods of making a pure Alcohol.* touch'd upon above; but no very facile and cheap Method of doing it to the utmost perfection, is known at present. Those who have any Curiosity this way, may try the thing by long Digestion;

gestion; or repeated Distillation from Water into Water; where the essential Oil will at once be left upon two Surfaces, and the Acid be imbibed. The shorter ways are those by Rectification upon neutral, absorbent Salts and Earths, as Sugar, Chalk, &c. And, lastly, by the use of *fix'd Alkalies*; which indeed greatly keep down both *Pblegm* and *Oil*: infomuch that this last Method seems the shortest, if the Art were known of utterly abolishing the alkaline Flavour, which the Alcohol acquires in the Operation; and which, for the present purpose, is not suitable, as absolutely destroying all Vinosity; that universally consists in a fine volatile pungent Acidity: tho' this Vinosity may be recovered, after having been thus destroy'd; as we have shewn above*.

The difficulties, however, usually met with in procuring a perfect *Alcohol*, either with or without *fix'd Alkalies*, are esteemed so great, that our Distillers scarce think it worth their while to attempt the thing, in any manner. They are all of them for the short, the facile, and the cheap ways of working; and laugh at the slow chemical Methods by Sand-heats, Water-baths, and Glasses. But how contemptibly soever they may judge of this matter, there are those who can work *Spirits* to as much profit in this slow chemical way, as they in their hasty one. And till the Distillers can let go their hurry and fondness for dispatch, they ought not to expect any great success in the business of *Rectification*, and clean working.

*Hints for
procuring a
tasteless Spi-
rit.*

There is another Method of procuring a *Tasteless Spirit*, almost at the first Operation; which, complying with the Temper of the Distillers, would fit them admirably, if they could make

it

* See Pag. 117, &c.

it come cheap enough. There is in *England* an immense quantity of a cheap vegetable Substance, easily procurable, and easily fermentable into a *Wash*, that yields, by common Distillation, a Spirit almost tasteless; which may, with great ease, be made the perfect *Alcohol* we speak of. But for the common purposes of Distillers, it need not be drawn so high; as having, in the form of common Proof-Spirit, such a degree of true vinosity, yet neutrality in Taste and Odour, as renders it fit to mix in an equal, or a much greater proportion, with the finest foreign Brandies or Arracs. That the Distillers in their re-searches after all gainful Improvements in their Art, have hitherto missed, or over-look'd this *vegetable Subject*, is surprizing; because it can only be conceal'd from them by lying too much exposed. The only difficulty with them will be, when they have found the Subject, to make it yield Spirit enough; which they may do by a tolerable knowledge in the Nature and Business of *Fermentation*. Such a Spirit as this seems to be the grand *Desideratum* in the Art of Distillation: and is capable of performing all that can be expected from a Spirit; not only in the vulgar way of Distillers, but also in the ways of Chemistry, Pharmacy and Medicine. Such a Spirit is much more valuable and useful than any other possess'd of a strong Flavour. Whence all the finer Cordials, and the compound Waters of the Apothecary, should be made with it: so likewise should all the curious chemical Preparations that require an untartariz'd *spirituous Menstruum*. Several fine Waters, Essences and Tinctures, might also be extemporaneously prepared with it; by the admixture of the essential Oils of Vegetables, &c. And thus *French Brandy*, and other foreign Spi-

*And turning
it into Bran-
dies of all
kinds.*

cleansed, and render'd nearly insipid ; especially if a *Malt-Spirit* be chose: otherwise the Oil of the *Spirit* will prevent its being well impregnated with the virtues of the Ingredients, and also be apt to taste through them all. And for this reason, as well as others, the Spirit should be brought into the form of *Alcohol*. At least, if a clean proof-less *Malt-Spirit* cannot be procured ; let a fine *Melasses Spirit*, which tho' Proof, shews thin and attenuated, be used without any farther addition of Water in the Still. An additional quantity of Water only takes up room to bad purpose, and not only prolongs, but prejudices the Operation. And when *Alcohol* is employ'd, let it only be mix'd with an equal quantity of fair Water.

In the next place, due regard must be had to the business of *Digestion* ; without which the virtues of some Ingredients will not rise in Distillation. Thus, without good *maceration*, the ponderous Oil of the *Cinnamon*, is not very ready to rise with the *Spirit* : whence the virtue of it sometimes remains in the Still ; and requires to be fetched out by cohobation. The Apothecaries, to avoid this trouble, or for other reasons, are usually content to have their *strong Cinnamon Water* poor, that their *small Cinnamon Water* may be rich. But this is perverting the Design of the Physician ; who expects both to be made in perfection, and *secundum artem*.

When the Ingredients, according to their respective natures, have stood a due time in *Digestion*, the Spirit is to be drawn from them in the manner that best tends to bring over the virtues, whereon the character and expectation of the Water are founded. So if the Ingredients naturally abound in a heavy, viscous Oil ; the Operation should be performed with a brisker
Fire,

Fire, than when the Oil is thin, light, and ethereal. Thus strong Cinnamon-water, after sufficient digestion to loosen the Oil, might be drawn over smarter than *Citron-water*, the *Spirit of Mint*, or the like; where the essential Oil ascends much easier along with the Spirit.

The capital Thing of the whole rests here, that a *due proportion of the finer essential Oil of the Ingredients be received into, and embodied with the Spirit*; whilst the grosser, less subtle, and less agreeable Oil is kept out. To effect this fully, requires, (1.) That the operation be well regulated from the first; (2.) That the Receiver be changed in due time; and, (3.) That the Spirit be prudently made up. When no regard is had to these several particulars, as it rarely seems to be among the Apothecaries; the consequence is the production of a milky, thick, turbid Liquor, that tastes more like what the Distillers call *Faints* than a *Cordial Water*; and indeed, seems more fitted to give sickness, than to cure it. At least, before it can be used, it must either stand a long time to fine of itself, if ever it will fine; or have its gross, unctuous, and terrestrial Parts precipitated by Art. On the contrary, when these *Rules* are prudently observed, the water proves, without farther trouble, clean-tasted, clear, brisk, pleasant and refreshing; supposing it intended for a common Cordial, and not for Physic.

What seems to have led the Distillers into this clean way of compounding, is their particular esteem and fondness for the *Bubble-Proof*; a thing little understood by *Apothecaries*, and less regarded in their productions. The *Distillers*, in the making of compound waters, find, if they suffer their *Faints* to run among the high Spirit; this procedure kills their *Proof* before its time. Hence
they

the same time makes the Water taste softer and pleasanter in the mouth.

And if these particulars be well observed, the *Apothecary* may doubtless make as good *Cordial Waters* as the *Distiller*, without the assistance of the *Balneum Mariæ*: which however is a lawful Engine, in reserve for the *Apothecary*, if he can no otherwise get the advantage over his *Adversary*.



S U P.

S U P P L E M E N T.

Of the Structure of a Still-House.

BY some particular Contrivances in the *Structure of a Still-house*, the Work may be shorten'd, and render'd more agreeable as well as advantageous. In this particular the *Dutch* Distillers seem to exceed the *English*, who are neither so neat nor so ready in the business as they might be; but appear commonly embarrassed in Slush and Dirt, whilst they continue at work. To reduce this affair to an elegant Simplicity in *England*, we might do well to have the *Still-houses* of *Holland* in view, and endeavour to improve them.

1. The first Caution in building of a Still-house is, to lay the Floor a-slope, where the wet work is to be perform'd; and to have it well flagg'd with broad Stones, so that the Slush may readily run off, and be discharg'd by the Vents or Drains on the sides.

2. The Stills shou'd be placed abreast, along that side of the Still-house, to which the Floor has its current. The Stills in *Holland*, for their largest *Malt-works*, are never of that monstrous size we commonly find them about *London*; but much more manageable and handy; as seldom containing above six or eight Hogsheads; and with such Stills a single Hand will perform much more business than in one of thirty or forty times the size.

3. Front-

How

A N
S S A Y

Towards a

PRACTICABLE METHOD

OF

CONCENTRATING WINES,

And other

FERMENTED LIQUORS;

to reduce their *Bulk*, render them
irreversible and *Perfect*, more
valuable and fit for *Service, Carriage,*
and *Exportation.*

3. Fronting the Stills, and adjoining to the back-Wall, shou'd be a Stage raised for the *Fermenting Backs*; which being placed at a proper height, may empty themselves, by means of a Cock and a Canal into the Stills; which are thus charged without farther trouble.

4. Near this Set of Fermenting Backs, shou'd stand a Pump or two, that may readily supply them with Water; by means of a Trunk or Canal leading to each Back.

5. Under the Pavement, adjoining to the Stills, shou'd be a kind of Cellar, wherein to lodge the Receivers; each whereof is to be furnish'd with its Pump, to raise the Low-Wines into the Still for Rectification. And thro' this Cellar the refuse Wash or Still-Bottoms, shou'd be discharged; by means of a Hose, or other Contrivance.

These are some of the principal Matters to be regarded in erecting of a Malt Still-house; or any other design'd for the original Production of Spirits. And by a due regard had to them, *Malt-Spirit* may be made with little more trouble than Melasses. For by this means the business of *Brewing*, and *Cooling the Wash*, which requires so much time and pains in the *English* manner, is entirely saved; Fermentation carried on to better advantage; and the Yield of the Spirit increased, according to the Process already considered, under the *Sections* of *Brewing* and *Fermenting*.



A N
E S S A Y

Towards a
PRACTICABLE METHOD
O F
CONCENTRATING WINES,

And other

F E R M E N T E D L I Q U O R S ;

So as to reduce their *Bulk*, render them
more *Unalterable* and *Perfect*, more
Durable and fit for *Service*, *Carriage*,
and *Exportation*.

ADVERTISEMENT.

THE following Essay opens a new Way of working in Chemistry; and shews how to analyse certain Bodies by Cold. Chemistry should not wholly confine itself to the Fire; when there are several other Agents and Instruments in Nature, no less efficacious than that, in producing Chemical Effects; and principally Cold; which must be allow'd the left hand of Chemistry, if Heat be the right.

But besides these two; Air, Water, particular Motions, and particular Bodies have an instrumental efficacy in producing great Changes, both artificial and natural; and unless Chemistry make use of these, as well as the others, it must still continue very lame, and imperfect. Many things of this kind are hinted to the world by that noble chemical Philosopher Dr. Stahl, who has given the whole Art a new Cast, and shewn it a much more serviceable thing in Philosophy, in Arts, and the business of common life, than is generally conceived. To him we are obliged for the following Essay; which contains an account of a curious, and, in all probability, a very profitable Experiment. The Matter of Fact was indeed known before; but not experimentally deduced, confirm'd, and explain'd. Glauber speaks much of a certain Secret to the like purpose; but in such Terms, as if he either understood not himself, or intended not to be understood by others: and indeed he trumpets upon it in such a tumid manner, as ill becomes a Chemical Philosopher; who should never lose sight of Nature, nor stray beyond the limits of Experience. Mr. Boyle touches the matter soberly and discreetly, in his Natural History of Cold; but seems unacquainted with its excellence, and numerous uses. What may be farther wanting to render it practicable, in the larger way of business, the Merchant and Mechanic may consider of; but the discovery of its farther Chemical and Philosophical Uses, is earnestly recommended to the British Philosophers.

A N
E S S A Y
T O W A R D S
A PRACTICABLE METHOD
of Concentrating WINES, and other
*fermented LIQUORS, &c. **

S E C T. I.

FUNDAMENTAL OBSERVATIONS *upon*
the Real, or Chemical Nature of
WINE; *and* all FERMENTED
LIQUORS.

1. **W**INES, and fermented Liquors, Nature and texture of the original matter of Wines.
both before and after Fermenta-
tion, consist not of similar, but
heterogeneous parts; joined together in one, cer-
tain

* This Subject having been curiously prosecuted by Dr. Stahl, in a Work of his but little read in *England*, we chuse to give the Substance of what he delivers upon it; and add our own Observations, Experiments, and Illustrations occasionally, in the way of Notes; as judging it much better for the public, to spread what is already well done, by such excellent hands, than to write entirely from the narrow confines of our own Experience. And this Method we propose to observe for the future, where we find any Chemical Subject usefully

M prosecuted

tain determinate order. Thus, the action and essence of *Fermentation* being a separation and destruction of the former connexion of the subject; and transposing its parts anew: there must of necessity have been a kind of firm or durable texture, in the subject so disjoin'd, separated, and new ranged *.

2.. For example, *Grapes*, being laid upon dry straw, in a cold place, will, for some time after they are separated from the Vine, preserve that texture which gives them, their saline, unctuous, and slimy sweetness; which the juice also retains after pressing, and becomes a clear transparent Must: without separating it self into heterogeneous parts, but continuing uniformly and evenly mixed; so as to preserve the different matters it consists of intimately collected among themselves. And in this firmly connected state, it may be kept for many months; if a cask be perfectly filled therewith, and set in a cold place, as we evidently see in *Stum*.

Nature of
Wines them-
selves.

3. *Wine* in the precise Chemical, or Philosophical Notion thereof, is a saline, clammy, oleaginous matter, diluted with a large proportion of

prosecuted by foreigners, or Authors but little known or read in our own Country.

The Paper from whence this *Extract* is taken, occurs among the Doctor's other *SCHEDIASMATA*, under the following Title. *Mensis October, commendans Concentrationem, five Dephlegmationem Vini, aliorumque Fermentatorum, & Salinorum Liqueurum, salvis universis eorum viribus. Opusculum Chymico-Physico-Medicum. Halæ Magdeburgicæ. 1715.*

* This *Essay* proceeds in the aphoristical manner, wades pretty deep in natural Philosophy; and carries a steady Eye upon the texture, connexion, or arrangement of the particles of Bodies; whereon their nature and properties depend. We must therefore beg of the Reader to consider the matter in this light; and to expect rather Science than Ornament.

of water; whereby 'tis set at a distance from it self, or expanded; whilst the saline parts are saturated with, and interspersed among the subtile earthy ones, that make the sliminess; and thus they together imbibe, detain, entangle, and hold the grosser oily parts: besides which, there are other oily parts vastly more subtile, that by means of the highly attenuated saline portion adhering to them, remain as much connected with the water as the rest; and these are what we call the spirituous parts. But the connexion of them all together, is so strong and durable, that they move, for a long time, as one body, without separating, if carefully preserved*.

4. But if the *spirituous part* be once drawn away, and separated from the *Wine*, by distillation; tho' it were again immediately poured back, or restored to the remaining mass from whence it came, and ever so finely shook in again therewith; the whole by no means recovers its former taste, odour, and durability; but turns to a confused, turbid mixture of a different, nauseous taste, unnatural smell; and approaches near to a state of vappidity†.

Wine, being affected by taking away its Spirit.

M 2

5.

* An acquaintance with the true Nature, History and Effects of *vinous Fermentation*, will fully explain and justify these positions. The Author himself, Dr. Stahl, has given us a very laborious and exact piece upon this Subject; which we hereafter propose to illustrate in the same manner as the present.

† This holds true in the general: but if a new Fermentation, or even a Fret, be naturally or artificially raised, after they are put together again; the Spirit may be thus reinstated, and the Wine render'd perfect; as I have seen. The experiment however is usually attended with some difficulty and uncertainty; tho' capable of being render'd successful by a particular *Encheiresis*, or the use of a proper intermedium.

*How by a
new addition
of Spirit.*

5. Again, if an inflammable Spirit, distill'd from the same, or any other kind of Wine, be put to a parcel of Wine that was too saline, or not sufficiently spirituous; the bare addition, or tumultuary admixture thereof, very far from giving the fine and intimate softness of a good wine, will rather manifest its own burning acrimony, and nidorous flavour, to the smell and taste; and also add a nauseous bitterness to the former tartness and austerity *.

*How affected
by Heat.*

6. So likewise any considerable heat, or even a degree of simmering or tepidity, will by its intestine and subtile agitation, that barely disturbs the exceeding fine spirituous parts, which are very susceptible of the motion of heat, or disjoins them from the rest, occasion an alteration of its taste, transparency and durability; as much as if the Spirit had really been drawn off, and poured back again †.

*How rendered
durable.*

7. On the other hand, *Wine* kept in a cool vault, and well secured from the external air, will preserve its texture entire in all the constituent parts, and sufficiently strong for numerous years: as appears not only from old wines, but other foreign fermented liquors; particu-

* This likewise holds true, if no proper caution and encheiresis be used; but if a fine Spirit be artificially prepared and introduced, it will after a time be intimately mix'd with the other parts of Wine, and remain absolutely undiscoverable to the taste and smell, unless by the excellence and strength it gives.

† This is a common accident, and a disease in Wines kept too hot; and not easy to cure, when of long continuance: otherwise it may be remedied by introducing a small artificial Fermentation, that new ranges the parts of the Wine, or rather recovers their former texture. But the thing here intended, is the actual exposing of Wine to the Fire or hot Sun; which presently disposes it to turn eager: and making the Wine once boiling hot, is one of the quickest ways of expediting the Process for Vinegar.

particularly those of *China*, prepared from a decoction of *Rice*; which being well closed down, and buried deep under ground, continue for a long series of years, rich, strong, and generous, as the *Histories* of that Country universally assure us.

8. The like is also to be understood of *Vine-Vinegar*, after it has thrown off the super-abundant earthy parts, and many of the oily ones, that presided whilst it continued Wine; whence the saline ones now get the ascendant, and as it were subdue and preside over the spirituous: for good and perfect Vinegar being well stopt down, will continue pure, and unaltered, for a great length of time.

9. But if it be left open, so that its fine vapour exhales, or its more subtile part be drawn off from it; and again poured back: in either case, it loses its uniform consistence, and particularly its durability, and now directly hurries into vappidity and corruption.

10. If either by fraud or accident, a larger proportion of Water comes to be mix'd with Wine, than is absolutely proper for its consistence, and no way necessary or essential; this superfluous Water does not only deprave the taste, and spoil the excellence of the Wine; but also renders it less durable: for humidity in general, and much more a superfluous aqueous humidity, is the primary and restless instrument of all the changes by fermentation *.

M 3

II,

* That *Water* is the principal Instrument of Fermentation, will be fully shewn and explain'd hereafter, in the chemical Doctrine and practical Experiments of Fermentation; which we reserve for the Introduction to our *Natural and Experimental History of Wines*. In the mean time, it appears, in some measure, from what is deliver'd below, at the beginning of Sect. V.

11. It may therefore doubtless be useful, and sometimes very convenient, to take away this *superfluous Water* from the other part, which strictly and properly constitutes the *Wine*. But for the method wherein this may commodiously be done, we will first examine those proposed by others, for the purpose; shew their difficulties and insufficiencies; and afterwards propose a perfect and easy way of effecting the thing.

* S E C T. II.

Of the METHOD of Condensing WINES by HEAT, or EVAPORATION.

*Superfluous
Water in
Wine.*

I. **W**HOEVER considers it, will find, that all fermented liquors labour with an over-proportion of Water; and that if a very considerable quantity thereof were taken away, they would become not only richer, but more durable; provided so much humidity were still retain'd, as is just necessary to preserve the vinous consistence, keep the saline part fluid, and the slimy and the unctuous parts mix'd in and expanded along with the rest.

*Effects of the
Spirit and
Water being
separated
from Wine.*

2. But as an actual and truly saline matter abounds in *Wine*, and *Vinegar*, and that of an acid austere or tartarious kind; when the spirituous part is drawn away, the *Wine* becomes surprisingly more austere: and when a large quantity of the watry part is separated, this superabundant saline tartarious matter coagulates into a crystalline form, and falls to the bottom, or strikes to the sides of the Cask. For the subtiler oily matter, which makes the spirituous part in *Wine*,

Wine, blunts and takes off from a tartarous acidity; in the same manner as the addition of rectified spirit of wine blunts, sheaths and dulcifies the corrosive acid spirits of *Nitre, Salt,* and *Vitriol.*

4. But this *tartarous Salt* abounding also with an over-proportion of a gross unctuous matter, cannot be dissolved or diluted without a very large proportion of water; which being taken away, it presently concretes into dry solid crystals: as is the known case of *Cremor Tartar.* And hence proceeds the effect before observed; *viz.* that the acidity and roughness of the Wine manifest themselves the more, when the Wine is deprived of its spirit. And this is an experiment familiar in the kitchen; when Wine is burnt or used in sauce: for boiling, always gives it a much greater degree of austerity.

5. And when this Water is, even by distillation, plentifully drawn off from Wine, not of a terrestrial and chalky, but of a tartarous nature; a beautiful Tartar will be found to crystallize among the remaining mass, in a considerable proportion.

6. But altho' this superfluous Water, that distills the Wine, and greatly weakens its taste, might be very advantageously spared from the Wine, which wou'd then become much more rich and noble; and at the same time more smooth and soft, thro' the loss of some part of its Tartar; yet this end cannot be secured by distillation, because of the damage it does to the remaining mass, and destroying those properties thereof which ought to be preserved.

7. For first, the spirituous part is the life of the wine and all fermented liquors; and not only keeps them together, embalms the whole, and renders it durable, or not subject to corruption; but also in great measure gives them that aromatic

matic, refreshing, and restorative virtue and effect they have upon the human body.

8. Nor is this all ; but the intimate and extremely subtile union of this spirituous part with the rest, is perfectly the sole and entire cause of both the former effects : so that it by no means suffices to have the spirit barely present among the other parts, for then it might be drawn off and return'd back again, without damage to the wine ; but the essential union is here dissolved by taking it away, and can never be restored by a simple re-affusion. 'Tis therefore destructive of the end propos'd, thus to break and dissolve the texture of the Wine, as this entirely subverts and corrupts its nature.

9. And this inevitably proves the case, whenever *Wine* is evaporated or distill'd : which constantly requires a degree of heat sufficient to convert water into vapour ; whence the spirituous part being much more volatile than the aqueous, flies off together with, or even before it ; and thus leaves the Wine dissolv'd in its texture, and without its soul. Upon which, the remaining saline, slimy, unctuous mass is so disturbed, as no longer to remain connected, but immediately turns thick and turbid ; and afterwards runs impetuously into a kind of corruption, attended with vappidity, ropiness and finew. All which circumstances abundantly shew the method of exhalation to be absolutely unfit for *condensing Wines* ; as it so many ways destroys the whole vinous texture and compages.

SECT.

S E C T. III.

Of the METHOD of Condensing
WINES by PERCOLATION.

1. **T**HAT *Wine*, strictly and properly so call'd *, is of a grosser and thicker body than Water ; or that the essential and truly constituent parts of Wine, may be consider'd as separate and distinct from a superfluous and copious aquosity, appears both *à Priori* and *à Posteriori*. *The density or grossness of a vinous body.*

2. For first, 'tis rational to conceive that a matter consisting of a collection of saline, slimy †, and unctuous parts, brought into one mass, should have a grosser consistence than pure and simple Water.

3. And next, this grossness of the proper and essential particles of Wine manifests itself to the eye, (1.) In those diseases of Wines, wherein they become viscous and ropy : when they not only lose their transparency, but may be drawn out and extended like a mucus ; and do not, upon pouring out, then fall in drops, but run down in long ropy strings. (2.) It appear again to the eye in *Vinegar* grown mothery, mucilaginous, and tough, so as sometimes to afford

a

* That is, Wine freed from its superfluous and prejudicial Water.

† This slimy or mucilaginous part of Wine, ought particularly to be remarked ; as a real constituent and often a predominant part, manifest in all the states, but especially those termed the præternatural states of Wine ; and both before as well as after Fermentation.

a dense skin, like leather ; which cannot well be supposed to proceed from the Water, but from the more proper and essential parts of the Wine it was made of.

4. But because these *Inspissations* may possibly be attributed to some preternatural disorder of the Wine, we may add, that our *Method of concentration* exhibits this grossness of parts to the eye ; whilst the Wine remains in a perfect state, free from its superfluous aqueosity : for here it appears much denser, and deeper in colour, less fluid, less thin, less transparent, and in every respect of a thicker and higher consistence.

5. Lastly, this is still more evident in *Malt-liquors*, which being concentrated in our manner, taste full and thick, almost like Oil in the mouth, and pour out like that, or a thin Syrup ; being at the same time also heighten'd, or concentrated in colour.

Lays the
Foundation
of a Separation.

6. From the preceding phænomena, it shou'd seem natural, that these different parts of Wine, which vary so much in consistence and tenuity of matter, might be separated from each other by a commodious *Percolation* ; so that the aqueous parts which appear the finest, shou'd run thro' the pores of a proper strainer, and leave the grosser behind.

The inconvenience of the Method by Percolation.

7. But the practice hereof is clogged with great difficulties. For *first*, those thin liquors which have a manifest and copious saltness, as Wine has, are either so attenuated ; and their gross part, however thick in comparison of Water, is yet so subtile and penetrating in it self, as at the same time to pass the pores of any ordinary strainer : at least such liquors will, along with their aqueous, transmit the finest and most delicate of all their parts, and leave the more slug-

gish, the truly grosser, or those most tending to ropiness, behind*.

8. It must also be observ'd, that most kinds of *Wine*, beside their genuine, substantial and rich, essential part, have constantly join'd with them some foreign superfluous and prevailing gummy or mucilaginous matter; which the more it inviscates the nobler part, the thicker and grosser that actually becomes; whilst the other finer portion, which is not clogg'd with such a load, remains more penetrating and active. And hence also the difficulty of condensing Wines by percolation is increased; as this subtle spirituous part passes the strainer along with the Water†.

9. A contrary difficulty attends the use of a close strainer; arising from the gross mucilaginous particles, either accidentally interspers'd in *Wine*, or cleaving to this and other fermented liquors, but especially malt drinks: for these viscous, tenacious, and clammy particles, presently clog and block up the pores of the strainer; and by that means hinder the thinner and more watry particles from getting away. And the natural tenacity or clamminess of liquors prepar'd from malt, honey, and the like, communicates, in the manner of a mucilage, such a ropiness, even to the superfluous water; and diffuses and expands it self so much therein, that the water it self is thereby thicken'd and rendered much less apt to flow.

10.

* This is the common case of all fermented liquors, tho' ever so fine and bright: and opens the way for explaining their nature and composition; the changes whereto they are subject; their diseases and their remedies.

† Whence the remaining *Wine* is depauperated and render'd vappid, instead of being meliorated. These two last observations will appear perfectly just, to those who have made any experiments, in this way, upon Wines.

10. A *third* difficulty attends this Method by *Percolation*, viz. that although it were possible to make the separation; yet the work would proceed so slow, that the more subtile, not so strictly inflammable, as fine, brisk, volatile, and spirituous parts, which give the pungent taste and odour, might in the mean time exhale, and leave the remaining Wine flat and vappid: or if this inconvenience cou'd be prevented, yet in so tedious an operation, some prejudicial fermentative alteration wou'd, in all probability, happen.

The Difficulty of finding a proper strainer.

11. And after all, there wou'd still remain a *question* as to the matter to be used for the strainer; which they who have never made any experiment this way, might little dream of. For as the common *filters* or *strainers* are generally made of paper, linen, or some kind of cloth; all these readily communicate and impress a foreign disagreeable taste to the liquor, especially to Wine, if intended for condensation in this manner. And it may seem surprizing, that even a momentaneous passage of *condensed Wine* thro' the cleanest linen, will give it a remarkable and very disagreeable *taste of the Rag*, that shall continue for many months, and cannot easily be got off again *. This happens in a much greater degree

* This is also a very great difficulty in the *Pressing of Wine-Lees*; which contain a very large proportion of Wine; that may readily be forced from them by the *Tail-Press*. But our people generally using Canvas Bags for that purpose, all *Press'd-Wines* may be distinguish'd by this *taste of the Rag*; unless great care be used. To prevent the inconvenience, as much as possible, their way is to soak the Bags, for a long time, and even to boil them in several parcels of Wine; which thus takes out the disagreeable flavour, and leaves the Bags more pure. Yet after all their endeavour, the Canvas still gives some little smatch to the Wine. So that it were better perhaps to have a particular kind of *Hair-cloth*, &c. wove for the purpose.

degree to *condens'd Wine*, after the same manner as the highest rectified spirit, or alcohol of Wine, will in many cases perform a solution immensely quicker, and more powerful than such a phlegmy spirit, tho' mix'd but with a tenth proportion of Water: for so our *concentrated*, or, as we may call it, *rectify'd Wine*, being freed from its superfluous phlegm, has a more powerful, more immediate, and more intimate effect upon the parts of the cloth, and other bodies, by means of the concentration of its spirituous and saline parts, than when its efficacy is weakened by being diluted with Water †.

12. This Method however by *Percolation*, tho' *The Use of Percolation.* no way sufficient to free the *Wine* of all its superfluous Water, may yet be of some small service, if apply'd with due regard to the difference there is between fermented liquors, especially in point of consistence. And therefore some faint or imperfect imitation of *our Method* may be had by means of thick paper filters, or other common strainers. And in this view, that common tavern trick, with a piece of list, when dextrously perform'd, might be of some service: for if a long and thick woollen string be first soaked in Water, and then one end of it plunged into Wine, whilst the other end hangs a great way down, without the glass; it will, in an imperfect manner, draw away the Water from the Wine. But all these and the like attempts are trifling and useless, in comparison of our easy, expeditious and perfect manner of effecting the thing: to which we next proceed.

S E C T.

† This affords a noble and very improveable Hint of the power of *concentrated or rectified Wine*, used as a Menstruum: and we cou'd wish for an opportunity of making some certain experiments to this purpose. But more of this below. See Sect. V. *sub finem*.

S E C T. IV.

*The METHOD of Condensing WINES,
and other SALINE SPIRITUOUS
LIQUORS, by COLD.*

Transition. 1. **H**AVING above shewn what effect the Motion of Heat and the Action of Fire have upon all, but especially the finer parts of fermented Liquors, and more directly upon those of Wine; and how much they contribute to dissolve the intimate union of vinous Fluids, and change their whole nature, which consists in that union and connexion: we pass on to the consideration of *Cold*; which being opposite to *Heat*, may be supposed to have different effects, or at least such as better suit the present purpose.

Foundation of the whole Invention. 2. If any kind of *Wine*, but rather such as has never been adulterated, be in a considerable quantity, as that of a Gallon or more, exposed to a sufficient degree of Cold, in frosty weather, or in any place where the Ice continues all the year, and so be brought to freeze; the superfluous Water contain'd in the Wine, will be turn'd to Ice, and leave the proper and truly essential part unfrozen; unless the degree of Cold should be very intense, or the Wine but weak and poor*.

3.

* This Fact was sufficiently known to the *Hollanders*, who winter'd in *Nova Zembla*; and has been imperfectly mention'd by several, in particular by Mr. *Boyle*, and other chemical Philosophers. And from the hint of Mr. *Boyle*, I made, during our last great Frost in *England*, a variety of Experiments, with different kinds of *Wine*, *Vinegar*, *Urine*,

3. When the Frost is moderate, the experiment has no difficulty, because, in that case, not above a third or fourth part of the superfluous Water will be froze in a whole Night: But if the Cold be very intense, the best way is, at the end of a few hours, when a tolerable quantity of Ice is form'd, to pour out the remaining Liquor, and expose it to freeze afresh by itself. And this for two reasons; (1.) Because when the quantity of Ice grows large, more of the *concentrated Wine* will be apt to hang and lodge in it. And, (2.) Because it wou'd otherwise require a longer time to drain away from the Ice *.

The Accuracy requir'd in the Experiment.

4. If the vessel that thus by degrees receives the several parcels of *condensed Wine*, be suffer'd to stand in the cold freezing place, where the operation is perform'd; the quantity lying thin in pouring out, or otherwise, will be very apt to freeze anew: and if it be set in a warm place, some of this aqueous part thaws again, and so weakens the rest. The *condensed Wine* therefore should be emptied in some place of a moderate temper, as to cold and heat; where neither the Ice may dissolve, nor the vinous substance, mix'd among

Urine, &c. and found the result exactly correspondent with what is hereafter deliver'd of this new method. And if the Author had any advantage in point of the natural strength of the Cold in *Germany* over that of *England*, we have supplied this defect by *artificial Congelation*.

* The making of the Experiment will render this extremely clear and intelligible: for without breaking the Ice, the unfrozen part will, barely by inclining the vessel, find its own way, and drain clear from the watery part, which is now in the form of Ice. So that if the draining be perfect, the Ice of the deepest red *Bordeaux* Claret, will become nearly as pale as Water; and resolve, by warmth, into an almost colourless Phlegm. Which is no small curiosity attending this Experiment; and at the same time affords a Criterion of its exact performance.

neat, and unadulterated with Sugar, Brandy or the like *.

This *Ice* of the second operation differs in no respect from that of the first; provided the vinous matter be perfectly drained away from it, before the *Ice* is set to melt; whereby it runs into the very same kind of fine Phlegm: excepting only, when the Wine was less spirituous, that it tastes a little more saline than the Water separated by the first operation †.

*Nature of
the Ice of
the Wine*

8. The part which has escaped being froze, in both operations, is a real *concentrated Wine*; as appears by its colour, consistence, taste and smell: for it now has all those properties in a greater degree, and a much narrower space, than when so largely diluted with a superfluous Water: and therefore becomes a much nobler and richer Wine, than without such a contrivance cou'd possibly be procured. For, as by this means two third parts of Phlegm are taken away, in the better sort of Wine; or three-fourths in the weaker; what remains must needs become highly rich and saturate ‡.

*Nature of
the uncon-
gealed part.*

9.

* No wonder at this separation of the Tartar in the Water, and the concentrated vinous matter; when the nature of Tartar requires a large proportion of Water to dissolve and keep it fluid. And perhaps from this Property might be derived a method of trying whether *Wines* are adulterated with Brandy, Syrups, Sugar or the like, by an unskilful hand: But if the proper art and address be used, such a discovery is absolutely impossible.

† This shews the perfection of the operation; as it loses not its efficacy upon repetition, but brings away mere Water at last as well as at first; without considerably robbing the Wine of any more valuable and genuine part.

‡ Trial and Experience alone can shew what a degree of melioration this condensation gives to Wines; by comparing them with a parcel of the same, that has not been condensed. Tho' this proof admits of some kind of fallacy; for the Senses

*Imperfection
of the Expe-
riment.*

9. This operation, tho' it be perfect in Wine, does not succeed altogether so well in rich *Malt-liquors*. Thus, for example, having by several condensations reduced a full gallon of strong Malt-liquor to the quantity of a pint and half; the Ice separated from it in the first concentrations, resolved into a liquor somewhat of the colour and taste of Small-beer; and that obtain'd at the last, might have almost pass'd for Small-beer, tho' a flashy, watry taste, manifestly predominated in it. But the part that remain'd uncongealed was extremely rich; and for consistence and taste far exceeded the famous double *Brunswick* Mum. In point of strength or spirituousity, it seem'd perfectly aromatic, and nobly flavour'd; a thing not found in common Malt-liquors. And for consistence, it resembled a dilute Syrup, and with a pleasing softness sheathed the acrimony of the spirit, and concealed the bitterness of the Hop; which before was very considerable*.

10.

here do not exactly judge of a small improvement. A true method seems to be that of reducing the condensed Wine back again to its former state; but to do this with accuracy and advantage, is a secret that will be touch'd upon hereafter. In the mean time, let the Water frozen out of the Wine be examin'd as to its degree of Vinosity; for the difference must needs be in the concentrated Wine.

* A faithful observer, and recorder of Philosophical Experiments, ever follows Nature close; and barely transcribes, or, as it were, exactly copies the Phenomena he observes: Accordingly the insufficiency of this *Experiment of Condensation* is here justly described, and its imperfections shewn, without palliating, or making the thing better than it really is: thus avoiding an Error that has strangely prevailed among natural, and especially chemical Philosophers, who are very apt to write in a romantic hyperbolical strain, and give imaginary excellencies to things, instead of keeping close to that rigorous truth and accuracy which natural and artificial Philosophy absolutely requires. The defect, however, of the present Experiment, is supply'd, or greatly lessen'd, by what immediately follows.

10. The mucilaginous nature predominant in *Malt-liquors*, here occasions a greater inaccuracy; as not suffering the condensed part to get clear, and run from the Ice: but as this liquor is cheaper than Wine, the loss is less considerable; and not only so, but if the operation were to be perform'd in large, the thaw'd liquor might commodiously be employ'd in a fresh brewing; so as with a slight *Encheiresis* to prevent all manner of loss. And thus likewise the Phlegm of Wine, separated in the operation, may, by a proper *Ferment*, be converted into good Vinegar; with a great deal of ease and moderate profit *.

11. What a large quantity of Water abounds in *Vinegar*, is well known to those who are skill'd in *Chemistry*; so that a great parcel of Vinegar will saturate but a small one of alkaline Salt: and again, a deal of *Vinegar* is required to dissolve a little quantity of Metal. A pint of the strongest *Vinegar* will scarce dissolve above two drams of Iron; or saturate more than the like quantity of good Salt of Tartar: but our method of condensation effectually remedies this inconvenience, and so far deprives the *Vinegar* of its superfluous Water, and so far collects its acetous penetrating sharpness, as to render it extremely powerful: thus throwing out five or six parts of uselefs Phlegm, that tastes scarce perceptibly acid; and at the same time retaining

N 2

the

* Every one versed this way, will easily perceive the truth, the justness, and practicability of what is here said. The *Encheiresis* mention'd, need be no more than to add the poor aqueous malt-liquor, not before the boiling, if any boiling be used, but in the *Tun*, as it is called; provided the brewing were rich enough to allow of it. And for making *Vinegar* of the depauperated phlegmy Wine, tho' it contains, even when the Operation is perform'd by a common hand, but very few vinous parts; Wine-Lees, Raisins, Sugar, or the like, is all the *Ferment* that need be employ'd.

the strength and virtue of the whole, in the part remaining uncongeal'd*.

This *condensed Vinegar* likewise towards the end of the operation, or in the last congelations, lets fall a white shining Powder or Tartar, in the manner above mention'd, as well as Wine †.

12. Again, the thicker the *Vinegar* is, the less fit it proves for distillation; as not only thus contracting an Empyreuma, but coming over oleaginous: insomuch that the purest white Salt of Tartar, being saturated with clear distill'd Vinegar, and afterwards ignited, turns black, and yields a smell like that of crude Tartar in calcining. And, on the other hand, the more 'tis diluted immediately before distillation, the less danger there is of burning. So likewise if the thick remaining Mass, when the thinner is distill'd from it, be again diluted with Water; it may, by a second distillation, be brought to afford a quantity of an acetous substance; tho' this latter be not comparable to the former extremely volatile part: which *Vigani* justly suspects is a thing known but to few ‡. And even when the *Vinegar* is distill'd with great labour, difficulty and care, it still has this effect in a higher degree; and contains an immense quantity of Phlegm, in proportion to its acid Salt.

13. Here also our *Method of Condensation* affords an assured remedy; first of all separating the more aqueous part; and in the next place, that which is somewhat acetous; tho' not comparable to what remains behind**.

14.

* This Experiment I have also found to answer fully upon trial.

† See above, §. 6.

‡ See *Vigani Medull. Chym.* pag. 13.

** So that, by this means, a most concentrated and subtilly spirituous distill'd Vinegar, may commodiously be procured;
viz.

§. 4. Of Condensing Wines by Cold. 181

14. How disagreeable and nauseous 'tis to pre-^{To Urine.}pare the *Rob* of Urine, in the common way, for *Phosphorus* and other purposes, is known not only to the operator, but perceiv'd by the whole neighbourhood where 'tis done: and here again our new *Method* affords a ready and commodious remedy; and largely throws off the aqueous part, leaving the unctuous and saline ones behind, untouch'd by the cold, unless it be very intense*.

15. Lastly, this *Method* is applicable to the making of *Salt* from Sea-water, or poor Salt-springs; as readily separating the sweet water, and leaving a stronger *Brine* for the Coction: so as to require little more than commodious Receptacles for containing a large quantity of these waters in the freezing seasons, in cold countries; which countries are generally fit for this design, have numerous occasions for the Salt, and are commonly well supply'd with wood for boiling the Salt down from the Brine †.

And to the making of Salt.

N 3

SECT.

viz. by freezing the whole parcel of distill'd Phlegm, and distill'd Vinegar together; a thing of great moment to the curious in the *Chemia sublimior*, and those who understand *Hollandus*. And when the Vinegar is froze without distillation, by this means you have a noble *Rob*, or rich concentrated Vinegar, freed from its debilitating and useless watry part.

* There is little danger that the natural Cold of our climate, even in the severest winter, will prove too strong for this or the other condensations: it generally proves too weak; but may be quicken'd by a prudent use of the common freezing mixtures, made with Ice, or Snow and Salt, &c. But to suit the artificial degree of Cold in these cases, requires, at least, as much dexterity, as to suit the degrees of Fire in the several chemical operations.

† Here is a noble Hint for Merchants, and those concern'd in the *Fisheries*, &c. The Foundation of the thing is just and natural, and the Experiment is certain and well verified; But to reduce solid Experiments to profitable Works, something more is required than a Purse.

S E C T. V.

*The Advantages of the Method of
CONDENSING WINES by COLD.*

Excellence
of the me-
thod in
Wines.

1. **T**IS certain, that the best and noblest *Wines*, if exposed for several days to the warm open air of the summer, out of a vault or other proper Receptacle, will inevitably corrupt and spoil; throwing a mouldy or mucilaginous matter to their surface, and acquiring a degree of stench or vappidity, or at best turning to *Vinegar*: On the contrary, the *Wine* condensed in our manner, suffers none of these changes, upon being so exposed; but remains, for a long time, not only uncorrupted, but even unaltered, as we have experienced, for several years†. And as this difference is owing to nothing more than freeing the *Wine* of its superfluous Water; it may hence be fairly presumed, that *Water* alone is the principal or immediate Instrument of all the fermentative Motions and Changes of vinous Liquors*.

2. We

† The Fact itself is indubitable; for the real vinous part receives no manner of damage, but the greatest improvement, by the congealing Cold; tho' the Water, upon thawing from the Ice, is prejudiced or somewhat corrupted, according to the nature of all frozen bodies; unless thawed with great caution, or some particular *Encheireses*, mention'd by Mr. Boyle in his *History of Cold*.

* This Proposition, that *Water* is the primary and most effective Instrument in *Fermentation*, is finely deduced and demonstrated by the Author, in an express Treatise of *Vinous Fermentation*; where the whole Doctrine of this abstruse matter is delivered in the most scientific manner; and that difficult point fully clear'd and settled, in the way of a rigid and pure philosophical Inquiry. A work well deserving to be better known in the chemical and philosophical world. See the Note upon ¶. 10. Sect. 1.

2. We condensed, in our method, a Gallon and half of a poor, weak, austere, and acid Wine, to about a quart, in the winter of the year 1696; and put it into a glass bottle, whereof a third part remained empty, and stopt it only with a hard wreath of paper: and thus it stood, for the space of two years, in my bed-chamber; where, during the summer, when the weather was fair, the windows were open all day-long, and where also, in the winter, other aqueous Liquors usually froze. During this time, it was often open'd, and some of it pour'd out, both to taste, and otherwise to use; and yet in all this time it neither grew mouldy nor sour, nor suffer'd any separation of parts; only deposited a small quantity of Tartar, but retain'd its original consistence and taste entire: excepting some small change in both for the better †.

3. In the same manner we concentrated a somewhat better kind of Wine, to a little more than a fourth part; but the bulk of this did not keep so well as the former, as having many more tasters than that austere and disagreeable sort. When it was by degrees tasted away to half a pint, I put the remainder into a glass, and tied it over with a piece of bladder; then set it in the same place, near the former: but cou'd not prevent its being sift away by degrees, till only about three ounces were left. This small quantity stood all the summer, barely cover'd with a loose bladder; without alteration, or growing in the least mouldy or acid; and long after retain'd its most grateful taste and quick smell: only the latter was somewhat weaken'd thro' the bottle's remaining untied down. And that under this inconve-

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nience

† Several Experiments I made to the same purpose, fully confirm the truth of this.

nience it shou'd continue so perfect and entire, is really surprizing*.

4. I had, in the winter of the year before, condensed a very small quantity of the same sort of wine, to half an ounce, and put into an ounce vial; which remain'd, lightly tied down, all the next year, in my ordinary stove-room; where it kept, without corrupting, till after the end of the winter; when, by the unequal, and sometimes violent heating of the room, it became vapour and mouldy †.

In Vinegar. 5. A parcel of *Vinegar* concentrated after the same manner, in the winter 1694, and by that means brought to a corrosive degree of sharpness, which rendered it unfit for the table, stood in the same room with the concentrated *Wines*, for three whole summers and winters, without any manner of tendency to corruption, or the smallest sign either of mouldiness or ropiness ‡.

In Urine. 6. But *Urine*, concentrated in this manner, varies very remarkably, according as it was taken fresh, or half putrefied: that taken fresh, remains tolerably clear, of a dull yellow colour, and almost without smell; but that which was taken half putrefied, and of a colour betwixt brown and red,

* This shews the excellence of the method, in rendering liquors more durable and unalterable by any change of weather; which so greatly affects the common unconcentrated *Wines*.

† Let it be here again observed, that no romantic or extravagant commendations of the method are attempted, but its failures and imperfections every where noted; so as justly to copy Nature, and describe the effects, without flourish, vanity, or exaggeration. But the cause of this failure is evident; and nothing less cou'd be expected from the negligent manner in which the Wine was designedly kept.

‡ The uses and advantages of thus condensing *Vinegar*, were touch'd upon above, under *Sect. iv. §. 13. Note*; and may be as great to the *Vinegar-merchant*, as the concentration of *Wines* to the *Vintner*, &c.

red, acquired a dusky colour, by the concentration, like that of dark-colour'd Beer; and presently turn'd abominably fetid, if set in a warm place: But that taken unputrefied, remained so for a very long time. I kept a pint of it for two summers and two winters, without any remarkable change; it scarce finelling at all disagreeable or like Urine*.

7. These examples and experiments sufficiently shew, that Liquors thus concentrated, may, for a long time, be kept in a state of perfection, with little care†. But there are some particular changes of Wines and Vinegars, thus concentrated, that happen in process of time.

*Consequences
of the Ex-
periment.*

8. And first, *Wines*, upon being thus concentrated, seem to acquire a more austere taste than they had originally; and no wonder, as the condensation brings their saline and rough matter into a third or fourth of its original compass; so that this is no new addition or increase of the rough taste, but perhaps some degree of mitigation thereof, in regard of the closeness whereto this rough matter is brought; which of itself ought rather to multiply the effect in a greater proportion.

9. The change may be conceived owing to this, that all *Wines* are observed to grow mild and soft by long lying; which effect is greatly promoted in them by a successive separation of their Tartar, and a gentle evaporation of some part of their water; occasioning that necessity we find of frequently filling up the casks in the summer months: But in our concentrated *Wine*,
tho'

* Some uses of this Rob of Urine have also been mention'd above. See Sect. iv. ¶. 14. Besides which, it has many more in Chemistry.

† Doubtless as perfect, as long, and with as little trouble as can be expected, or need any way be wish'd for.

tho' some Tartar be successively separated, yet there is found no concurrent evaporation; for the concentrated *Wine* grows soft and mellow in a well-stop'd glass, where no sensible diminution of the quantity is perceived. But the effect proceeds principally from a closer combination of the grosser with the spirituous part; which now wanting water, successively throws off the grosser Tartar from the rest of the mixture*.

10. But besides this, there seems another remarkable change incident to our concentrated *Wine*, not only in the taste, but more abundantly in the smell; for although that very austere *Wine* above mention'd had a much milder taste the third year than the second, yet its specifick odour perfectly resembled that of *Sack* or *Canary*: so as to be mistaken for it, from the smell alone, by good judges, who were well acquainted with the original flavour of the *Wine* from whence it was concentrated†.

11. Nor is this change of odour peculiar to *Wine* alone; but concentrated *Vinegar* participates somewhat of it: and was observed for some time to lose it in great measure upon being left long stop't only with paper; and the bottle often poured out of||.

12. And, therefore, as 'tis plain that *Wines*, and all other fermented liquors, become much more

* This matter is farther illustrated from what was said under Sect. IV. §. 6. and the Note thereon.

† This is a high degree of melioration, to give a poor thin *German Wine*, the high flavour and richness of *Canary*.

|| Somewhat of this kind I also observed in a particular compound red *Vinegar*, made with Poppy-Flowers, &c. and condensed by freezing; but I have not observed that the fact holds in any respect of *Vinegar* thus condensed after it is once distilled: which happens very well for chemical uses. And thus *Wines* and *Vinegars* meliorate and gain a mellowness and richness from this operation, whilst they retain their true vinous parts; and again, when these are separated, the rest becomes more durable and unalterable by repeated congelations.

more durable by concentration, and yet this durability is here confirm'd and proved from small and inconsiderable quantities, wherein they always keep the worst; it is obvious that if the operation were perform'd in large, a great bulk of the liquor thus concentrated, wou'd be still immensely less subject to alteration, from the air and heat; which are the two great incentives to fermentative motions: and that if such small parcels suffer'd no change for the worse, much less would the larger*.

13. But as these *concentrated liquors*, by reason of their considerable proportion of saline and fine spirituous parts, have a less tendency to dissolution and corruption; so, on the contrary, the aqueous part separated from them, has a very strong tendency thereto: for as it takes from the Wine, and carries off with it a little of the mucilaginous and unctuous part, and yet is almost wholly a mere moveable, fluid Water, that is the most active instrument of fermentative motion, it cannot but presently fall into corruption†.

14.

* This reasoning is not only just, but actually confirm'd by experience: and I have my self long kept considerable quantities of concentrated Wines, without the least alteration for the worse, or any tendency thereto; even tho' no care were taken of the containing Vessel; tho' it were not half filled, and often left unstopp'd or the like. Nor is a high degree of concentration required to secure this end; tho' the higher it be carried, or the nearer to a rich syrupy consistence the Wine is brought, doubtless the less subject to change or decay. And this rich, syrupy, or rather more viscous or slimy, than truly syrupy consistence, is the exact height, whereto condensed Wines should be brought, to receive their utmost perfection: As any thing under this, leaves some superfluous or prejudicial aquosity; and any thing over, a degree of solidity, unsuitable to the true and essential nature of a *vinous substance*.

† When the Wine is separated by congelation into two parts, the one aqueous, and the other truly vinous, 'tis pleasing to observe

Uses of the
Experiment.

14. This business of *Congelation* is not only applicable to immediate profit, but also paves the way to certain matters of curiosity; and shews one particular, which tho' not new, but antiently common and familiar, has yet grown strangely into disuse, thro' the indolence of mankind.

15. As to the point of *immediate use*, it needs no explanation; for he must be very dull indeed, who does not immediately perceive that *Wines*, &c. by this Method may be reduced to any degree of vinosity, strength or perfection. Thus, for example, if a *Wine* of a moderate strength have a third part of its *Water* taken away, in the form of ice, by congelation; the remaining part will thereby be doubled in strength and goodness: for if in the better sorts of *Wines* we allow, as we may, one third part to be good or truly vinous, and two third parts to be *Water*; then that one third good part is divided among the two aqueous parts: whence, if one of the two aqueous parts be taken away, that same third part before divided between the two *Waters*, now remains collected or condensed, in a double proportion, along with but one of them †.

observe how soon the aqueous part corrupts, even tho' kept with the utmost care; whilst the other remains sound and unalter'd, for the longest time. I have seen this watry part in two or three days grow mouldy, fetid and nauseous; unfit for all manner of curious uses: insomuch that if intended for *Vinegar*, or to be employ'd in a new brewing, it should either be preserv'd by art, and a particular encheiresis, or else be used directly.

† Every one must needs see the great benefit and advantage of this Experiment, reduced to a work in *Wine-Countries*; so as to have *concentrated Wines* sent into foreign parts, instead of *Wine* and *Water*, or *Wines* loaded, and in a fair way of being spoiled by three or four times their own quantity of superfluous

16. But if this *Condensation* be carried up to the utmost, and practised in a large quantity, with a somewhat intense cold, it may perhaps reduce good Wines to a sixth: and this small quantity might commodiously be used as a quintessence to meliorate, improve, and even specificate smaller and low-flavour'd Wines*. For which purpose, it is perfectly well suited: whereas *Glauber's* method, with the quintessence or *essential Oil of Wine*, tho' prepar'd ever so curiously, from the most fragrant Wine, is no way proper to answer this end; but retains a nidorous and nauseous flavour, different from a true vinous nature †.

17.

fluos phlegm. But the business is how to freeze Wines in hot Wine-Countries: with regard to which, we only hint that in most Wine-Countries there are hills and mountains cover'd with snow all the year round. And wherever there is snow, no natural Philosopher can, at this time of day, be at a loss to freeze. So that the greater difficulty is, how to reduce the *concentrated Wines* again, without damage and loss, or bring them back to their first size, and render them fit for the companionable Glass, and not leave them only fit to be used in the way of high cordial or sweet-meat. For the bare addition of Water is not the perfect way: but a perfect way there is; and will be a little further touch'd upon at the close of this Section. In the mean time, if Merchants have not the address to find their account in this discovery, I hope at least Philosophers, Physicians and Chemists may.

* I have by the use of a proper *freezing mixture* condensed Wines in *England* still farther than the degree here mention'd; and find no reason to think it impracticable in very large quantities: but then a curious hand, or a curious method shou'd be employ'd about it. And thus indeed a noble rich Essence, or Rob may be procur'd, capable of working almost miracles, as to the turning of Water into Wine, &c.

† A fine quintessence, however, is obtainable somewhat in *Glauber's* manner, that mends poor Wines extremely, and gives a genuine or truly vinous flavour to such as are tasteless; as I have found by experience. But for improving all the truly vinous parts of Wines, the imitating of *Champaign*, *Burgundy*, &c. in *England*, &c. nothing that I know of is comparable to this Rob, or perfectly *concentrated Wine*. And doubtless,

17. Many high Commendations have been bestow'd upon the *Spirit of Wine of the Ancients*, and great things have been said of the *Philosophical Spirit of Wine*: And among other extraordinary Properties, it is celebrated for dissolving Gold. *Paracelsus* mentions this famous Substance again and again; sometimes covertly, sometimes more openly; but most particularly and expressly in the sixth Book *de Archidoxis*; and because the original is *German*, and little read we shall subjoin the whole passage, as containing somewhat extraordinary.

18. The Passage is this. " Observe, therefore
 " that the *Spirit of the Wine*, ought to be pre-
 " served along with the vinous *Substance of the*
 " *Wine*, and not with the *Phlegm*: for Wine
 " contains two Substances; the one *Vinous*, the
 " other *Phlegmy*. The vinous Substance is that
 " wherein the Spirit of the Wine lies, and from
 " which it should not be separated; but the
 " phlegmy substance is a feculent recrementitious
 " part, or sweet water, that ought to be
 " separated from the true substance, as a Metal
 " from its ore, earth or dross. Put therefore
 " a quantity of the oldest and best Wine, perfect
 " both in colour and taste, into a glass;
 " whereof it may fill a third part: seal the neck
 " *Hermetically*, and set it to digest in warm
 " Horse-dung, for four months, without suffering
 " it to cool. After this expose it, for a
 " month, to the cold of a severe frosty Winter
 " that it may freeze; by which means the Spirit
 " of the Wine, together with its grosser vinous
 " substance, will be driven into the middle of
 " the parcel, and separated from the Phlegm
 " which

doubtless, by means thereof, Men may have a Remedy for improving a bad Vintage, or mending the poor Wines of unseasonable Years, or unfavourable Places for Vines.

“ which Phlegm is now to be thrown away :
 “ but what remains unfrozen, is the *Spirit of the*
 “ *Wine with its true Substance*. Put this into a Pe-
 “ lican, and let it stand to digest a while in mo-
 “ derately warm Sand ; then take it out : and
 “ thus you will have the *Magistery of Wine* we
 “ speak of *.”

19. In other Places he mentions it under the name of *Concentrated Wine*, *Essence of Wine*, *Vinum Essatum*, *Alcohol*, &c. and frequently asserts, that *Spirit of Wine* is not an *inflammable liquor* : and with good reason declares it should not be separated from the vinous Substance ; with many expressions to the like purpose. We are not, however, from hence highly conceited of this magistery ; but know so much of it, as to judge it worthy the attention of Philosophers, no less than that thing of like kind, the *Essence* or *Ens primum of Baulm* ; which a certain modern author rejected upon the authority of *Paracelsus* ; but credited upon the attestation of *le Febure*, who vouched to the success of the thing. But this subscribing to Testimony, rather than to Experience, is what suits extremely ill with Chemistry †.

20.

* It is not without apprehension that we insert the two last Paragraphs from our Author ; as being well aware of the flur it may possibly bring upon the whole Performance, in the judgment even of some very eminent Philosophers, on account of the air it carries of the sublimer Chemistry, and the attempts of those vulgarly called the Adept. But we leave the thing to stand or fall by *Experiment* ; which is the only *Criterion* to be allowed in *Chemistry*. We have no View of turning Mens Heads to vain Pursuits ; but would gladly be instrumental in leading them on to moderate Things, of universal Use and Benefit. We therefore interpose not in the present Point ; desiring to gain a fair hearing in the lower matters we have to offer : which by degrees may pave the way to the higher ; if there shall be any thing solid and useful found in them.

† The Author here appears to mean Mr. Boyle, who is as severely charged by others, for giving too much credit to

Paracelsus.

20. Most of the ancient *Chemical Philosophers* profess they used *their Spirit of Wine* for dissolving Gold; but it is certain, that our common Spirit of Wine has no such effect: and if we may judge from *Rolfinck*, the Emperor *Rudolphus* employ'd this *Concentrated Wine* of *Paracelsus* for that purpose †. What *Vigani* says, as to the use of this Preparation, may be seen in his *Medulla Chymia*. But the philosophical uses of the Philosophical Wine, are not to our present purpose: Tho' we cannot help recommending a strict examination of these matters; and particularly what *Paracelsus* delivers upon the Subject.

21. To conclude, as to the direct and immediate use of our Method of Condensation; he who has the *Secret*, by means of a *little, dry, powdry Body*, of turning Water into Wine; will not, perhaps, easily divulge the capital use he may make of this Experiment ||.

Paracelsus: but the truth is, in things of this kind, he proceeded with great caution; and we do not find he had here any experimental knowledge of his own, to speak from; otherwise he valued Testimony in matters of Philosophy, but as a hint for farther Inquiry. What we have ourselves seen of this Preparation, belongs not to the present Subject; and indeed requires to be better examin'd, before we can speak to the purpose about it.

† See *Rolfinck's Chymia in Artis formam redact.* p. 184.

|| Here is somewhat covertly, but candidly and philosophically intimated the thing we mentioned above in our Note upon ¶. 15. of this *Señt*. The mystery lies in the words *little, dry, and powdry*: and a chemical Philosopher cannot well miss of the Interpretation. The *Body* is common, and *England* abounds with it. 'Tis totally and transparently soluble in Water, fermentable, perfectly white, and sweet as *Sugar*. But the Author goes not so far: and tho' we shou'd not have hit upon his meaning, we assert, from our own knowledge, the Fact here plainly delivered.







